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THE RECENT PROGRESS AND PRESENT CONDITIONS OF ECONOMIC ENTOMOLOGY[1]

FIFTY years ago, or even less, a very satisfactory and comprehensive text-book or manual of economic zoology could have been contained within the covers of a single volume of reasonable size. So great have been the advances, however, of late years, that the books and pamphlets published would in themselves make a small-sized library. The whole civilized world has contributed to the advance of economic zoology, and in its many directions it has greatly improved the condition of the human species.

It seems to be generally acknowledged that the greatest strides in one of its branches, namely, economic entomology, have been made in America, and therefore it has been thought appropriate at this American meeting to choose an economic entomologist to give the principal address, and to take economic entomology as his particular subject.

Thirteen years ago, in August, 1894, the present speaker delivered an address as retiring president of the Association of Economic Entomologists, in which he took as his subject, "The Rise and Present Condition of Official Economic Entomology." In this address (published in *Insect Life*, volume 7, pages 55 to 108) the early history of the warfare against insects was briefly discussed, the progress through the

[1] Principal address, Section of Economic Zoology, Seventh International Zoological Congress, Boston, August, 1907. Read August 23, 1907.

entire world was described, and the condition at that time in the different European countries, in the United States and Canada, in South America, India, South Africa, Australia, New Zealand and the then Hawaiian Republic, was given.

In the light of the progress of the last thirteen years it is interesting to read that address. At the time when it was written it was rather a surprise to those who read it, to see when all the facts were brought together, what an important subject economic entomology had grown to be, but from even this short distance of time it is safe to say that it was then in its infancy, and perhaps it is even now in its infancy—who can tell?

The closing words of the address were as follows:

> We have then done good work; we have accomplished results which have added greatly to the productive wealth of the world; we have justified our existence as a class (remember that the subject was "*Official* Economic Entomology"). We are now better equipped for the prosecution of our work than ever before, and it may confidently be expected that the results of the closing years of the century will firmly fix the importance of economic entomology in the minds of all thinking men of all countries.

This prediction has been more than justified. Up to 1894, the great features in this practical work had been the invasion of Europe by the grape-vine *Phylloxera* and the work done against this destructive creature by American and European scientific men; the work done by the different countries against locust invasions, the work done by the different states of the United States, and by the general government, against many species of injurious insects, notably the cotton caterpillar, of the south, and the very remarkable work carried on by the state of Massachusetts, which had then been in operation with increasing appropriations from the state for four years (at that time $325,000 had been spent), and in the address just cited it was called "one of the most remarkable pieces of work, judged by results, which has yet been done in economic entomology."

At that time the San Jose scale had just been discovered in eastern United States. It was known only in a few localities, and the discovery that it had been disseminated far and wide through nurseries had not yet been made. The tremendous effect of the spread of this most injurious species upon the popular estimation of the value of entomological knowledge can hardly be overestimated. This spread alone is responsible, probably, for more legislation in this country and in other countries, than all the other features of entomology combined—state after state on this side of the water has passed rigid laws, and country after country has issued decrees and passed laws concerning commerce in plants, all of them, nearly, of broad bearing and great importance, but all of them also incited by the dangerous habits of this pest. The San Jose scale literature published in these last thirteen years covers hundreds of thousands of pages, and hundreds of thousands of dollars have been lost through its work, but through the operation of state laws many entomologists have been employed, and through their work millions of dollars have been saved.

Although in 1894 the discovery had already been made by Smith, Kilborne and Salmon, that the Texas fever in cattle is carried by a tick, and although Laveran had already made the discovery that the causative organism of malaria is a protozoan of like habits, inhabiting the red blood corpuscles, the life history of this protozoan had not been made out, and the all-important discovery of Ross, that its primary host is a mosquito, had not been made.

When we consider the now generally recognized importance of insects as car-

riers of certain diseases of men and animals we realize that the discoveries of the thirteen years under consideration have been vital to the welfare of humanity, and that possibly we are as yet only on the threshold of discoveries which will prolong life and will conduce to added happiness of millions yet unborn.

The ticks and the mosquitoes of the genera *Anopheles* and *Stegomyia,* and many other biting flies, fleas, the common house fly, the bed bug and presumably other insects, are now recognized not only as nuisances, but as most serious menaces to health, and measures for the control of nearly all of them are becoming well understood, and all of this has come about in the past eight years. The enormous San Jose scale literature referred to in the preceding paragraph is exceeded by the literature of this subject. Not only have popular journals and scientific transactions been filled with articles dealing with these discoveries, but books have been written, and medical journals have been crowded with announcements of discoveries bearing upon this line of investigation.

Here, economic entomology has touched a new side of human interest; it is the health of man and not the preservation of his property that is concerned, and the interest has been a more vital one. The prime investigators, it is true, have been medical men, but the economic entomologists have done their full and most important share, and it has only been by the combination of the labor of both classes of workers, that the present results have been achieved.

In both of these last two developments of this period—namely, the San Jose scale work and the work against insects injurious to health, the whole world has been vitally interested, and in another department, which has reached the highest stage during this time, many nations are becoming interested; and that is the international work with the parasitic, or predatory, insect enemies of injurious insects. Originally suggested, and experimentally tried on a small scale, but with scanty results, very many years ago, the first successful large scale experiment was concluded in California about twenty years since, by the work of an agent of the United States Department of Agriculture, Mr. Albert Koebele. Both the state of California and the United States Department of Agriculture have carried on the work since that time, and they have been joined by the territory of Hawaii, by the colony of Western Australia, by South Africa, by the British West Indies, by Egypt, by Portugal, by Italy, quite recently by France, and at the present moment an entomologist from Chile is in the United States searching for beneficial insects to take back with him to South America.

All of this work was done on a rather small scale, although occasionally with excellent results, until three years ago, when the effort to introduce the European parasites of *Ocneria dispar,* known as the gypsy moth, and of *Porthetria chrysorrhea,* known as the brown-tail moth, into the United States was begun. In the northeasterly portion of the United States, both of these injurious insects introduced accidentally had spread enormously, and occurred in countless numbers. The percentage of parasitism from native American parasites was very small. The normal percentage of parasitism in the native homes of the injurious species was very great. There seemed to be no object in limiting the importations of parasites—the greater the number introduced, the sooner, it seemed, would success be reached; therefore, from the start the work has been done upon a very large scale. Hundreds of thousands of host insects containing parasites have been brought each year from

a large part of their European geographic range; more than forty species of parasites have thus been brought over, bred and liberated; several of them have certainly established themselves in New England, and there seems every reason to believe that speedy success will be reached. The single negative chance that native hyper-parasites will interfere can not be guarded against, and even should such species attack the imported parasites, it will probably not be long before a condition of more or less stable equilibrium among the host insects, the primary parasites and the hyper-parasites will have been reached. Every possible effort has been, and is being made, to prevent the escape in this country of the European hyper-parasites. This work is now going on in a laboratory at North Saugus, near Boston, and as it is by far the largest experiment of the kind ever tried in the history of the world, it will doubtless be interesting to the members of the section of economic zoology to visit this laboratory during the present week and examine the details and methods used. The speaker, who has special charge of this work, will be greatly indebted to members of the section for suggestions which they may make after an examination of the laboratory, which may assist in making the work more efficient.

Another almost unforeseen development in economic entomology, in the period under consideration, and one of very great interest and importance, has been the spread of the Mexican cotton boll weevil (*Anthonomus grandis*) in the United States. It has presented an enormous problem in economic zoology; the enormous damage it has done, and the fears it has aroused in other cotton-growing countries, have threatened a disturbance in the balance of trade for the entire world. At the time of the former address, in August, 1894, this insect had just made its appearance across the Rio Grande in the vicinity of Brownsville, Texas. Advancing year by year since then to the north and to the east, spreading at an average rate of perhaps seventy-five miles annually, it has now reached Arkansas and the Indian territory on the north, and the valley of the Mississippi River on the east. Many millions of dollars have been lost each year by the ravages of this insect. During the seasons of its greatest abundance, this annual damage has been estimated at from $15,000,000 to $30,000,000. In this spread we see one of the most striking instances of the value of scientific prediction, and the value of scientific advice in practical matters. At the beginning of its spread, the whole situation, as developed later, was predicted; and by a very small expenditure of money the insect could have been held in check and, in fact, exterminated easily. It occurred in a circumscribed region in which the value of the cotton production was not great, and the passage of a law by the Texas legislature to enforce measures, which could not have resulted in an expense of more than $20,000 or $30,000 to the state, would have entirely prevented the loss which has resulted from the ignoring of these recommendations—the recommendations were not only made by the Bureau of Entomology of the United States, but a bill was drafted in that office, the governor of the state recommended its passage in that session of the legislature; but with fatal economy, and with the fatal ignorance of the value of expert advice, the legislature failed to pass the law, and the insect steadily spread. Large sums of money have been spent by the general government in the investigation of all the factors connected with the life history, habits, method of dispersion and methods of control, and large sums have also been spent in actual field demonstrations upon

a large scale of the efficacy of the control measures recommended. Even these field demonstrations, however, have been met with a conservatism in cultural methods that has proved quite as fatal as the original failure to pass the initial control law. At the present time it seems that the further spread of the insect can not be stopped, but so soon as this crop method conservatism can be overcome, the cotton boll weevil will cease to be a pest of the first rank, and the cultivation of cotton can be carried on almost as successfully in its presence as it was in its absence. In the course of this investigation there has been accumulated a mass of information concerning this insect which has probably never been exceeded in the study of any one species. For six years a well-selected and large force of trained entomologists have been investigating every phase of its life, and this in itself has never been done to the same extent with any other species; but, curiously enough, this work has not yet been completed, and the reason is that the weevil coming from Mexico has been steadily advancing into new territory where conditions of the soil, temperature, moisture and crop methods are different. It has shown itself adaptable to changes in these particulars to an extraordinary degree; it is still advancing; it is still changing its habits, and we may reasonably expect to see marked differential developments between such radically different conditions as those that exist in the dry, sandy cotton lands of Texas and the moist climate and heavy soil of the Mississippi bottom lands. This investigation must therefore still continue.

In this work against the cotton boll weevil we see, therefore, another striking development of economic entomology. The large sums appropriated by congress and by the different states have necessitated the employment of an increasing force of trained entomologists. The agricultural colleges of the United States have been obliged to meet this demand for additional assistance; through this cause, and many others, already mentioned, or to be mentioned, the importance of training in economic entomology in these agricultural colleges has become intensified; the men at the heads of these departments of instruction have been obliged to change their methods; they have kept up with the progress of field and laboratory work and have trained their students in the newest developments. The increase in the number of scientifically trained and working economic entomologists has been remarkable, and will be referred to later in this address.

It has already been stated that the work of the state of Massachusetts against the gipsy moth was already well under way in 1894. This work has since had its vicissitudes, and it offers a remarkable example of what can be done and what should be done in face of great emergencies such as it presented, and still presents, and it offers also an extraordinary example of the shortsightedness, temporary, at least, of legislators. The work continued with excellent success down to the year 1900. The extermination of the gipsy moth at that time was almost in sight. It had actually been exterminated over considerable extents of territory. The conservative estimate of those in charge of the work placed the period of the termination of state appropriation at only a few years in advance. Mark the result. The appropriation was dropped in 1900, and for the next five years no work was done against this insect, except that done by private property owners. All of the ground gained by the former work was lost, the insect multiplied in increasing numbers, and a large extent of new territory became infested, making the problem many times more important

when the state again took hold of the remedial work in 1905. In fact, so greatly had the territory increased, so greatly had the insect multiplied as to do away practically with all idea of absolute extermination. An attempt at extermination on the same scale on which the attempt was previously made would almost bankrupt so rich an organization as the Commonwealth of Massachusetts. In the meantime, also, the insect spread beyond the borders of this state into Rhode Island, Connecticut, New Hampshire, and also, as has recently been discovered, into Maine. At last the general government was appealed to, and was appealed to distinctly in the terms of aid "to prevent the further spread of the moth." The brown-tail moth had in the meantime obtained a foothold in New England and had spread far and wide, and it too was included in the terms of the act of the general government, and also in the terms of the act of the state of Massachusetts. Appropriations were made by congress for expenditure during the fiscal year ending June 30, 1907, of $82,500, and for the fiscal year ending June 30, 1908, of $150,000.

In the meantime, the state of Massachusetts had appropriated under a very wise law $300,000 to be spent in the years 1905–8, and has appropriated again, the last winter, in cooperation with infested towns.

The states of Maine, New Hampshire, Connecticut and Rhode Island have also during the past winter made small appropriations covering operations for the next year or two. Here, then, is a gigantic effort in which no less than five states are making separate appropriations and are cooperating with the general government, which also makes an independent appropriation, the whole amounting to several hundreds of thousands of dollars, in an effort which, in its present phase, is devoted to the restriction of the further spread of these two pests, and toward relieving the conditions of damage which exist in the infested territory, until such time as the large scale experiment heretofore described in the introduction of foreign parasites of both species shall have culminated in a reasonable degree of success.

No larger scale work has probably ever been done, nor has any work in economic entomology ever been done in a more efficient and practical way than this combined work of the several states and the general government being carried on at the present time. The leader in this work has been the state of Massachusetts. Aroused by the disastrous conditions brought about by the lapse of appropriations in the years 1900 to 1905, the state has taken hold of the problem with an energy and intelligence commanding the greatest respect, and it has been this attitude on the part of the state that has induced the general government to assist on the principle that "Heaven helps those who help themselves."

It is interesting that the section of economic zoology of the Seventh International Congress should hold its meeting in Boston, the center of this great piece of economic work, at a time when its results can be plainly seen, and visiting members should utilize the opportunity to familiarize themselves with the details of this work. Very wisely, the work of the state of Massachusetts has been placed in the hands of Mr. A. H. Kirkland, a trained entomologist and a man of great executive ability, and in his hands it has become a great object lesson.

While the work already mentioned has perhaps had the most important bearing upon what may be termed "the rise of economic entomology" during the past dozen years, there has been an enormous amount of other work, of almost equal im-

portance; there have been important developments in methods; there have been important discoveries in the life histories of many species, leading to better measures of control; there have been important widenings of the field in many directions. Only a few of these can be mentioned at this time, and perhaps those chosen will not, after all, be the most important.

The demonstration work in connection with the cotton boll weevil has been mentioned, and this in itself is an important new factor in our work. It seems to be not enough to tell a man that he can accomplish certain results by doing certain things; to establish perfect confidence it is necessary to prove this, and to prove it not by laboratory work, but by field work, and by field work on a large scale. The first demonstration work of this character was probably that carried on by Mr. C. B. Simpson for the Bureau of Entomology in the work against the codling moth, in Idaho, in 1902. Here a large commercial orchard was treated according to the most approved method, and a check orchard was left untreated. The results were exhibited to apple-growers in the autumn from the states of Idaho, Oregon and Washington, and the demonstration was so perfect as to induce a wide-spread adoption of the methods used. In Texas and Louisiana this demonstration work was carried on at first by the Bureau of Entomology, and later, after the methods were shown to have been sound, by the Bureau of Plant Industry, and upon a very large scale. In the same way, during the summer of 1906, cooperative work against injurious insects and fungus diseases of fruit orchards was carried on by these two bureaus in Nebraska, and during the present summer this work is being repeated in other states. The value of this demonstration is very great, and as before stated, introduces a new element into the work.

The international work with parasitic and predatory insects referred to in my previous paragraph is of course suggestive of what may be done with parasites of injurious species in a single country like the United States, which is of broad extent, and in which the climatic and crop conditions vary so considerably.

The Hessian fly, for example, that great destroyer of wheat, has in certain seasons and in certain localities parasites which reduce it to a minimum, but it has been shown that in the spring of certain years these parasites will be competently abundant in one region and practically absent in another. Advantage has been taken of this fact by Professor F. M. Webster, of the Bureau of Entomology, and his corps of assistants, to study and import from these regions of parasite abundance, parasitized puparia of the Hessian fly into regions where the parasites upon actual examination have been found to be absent. During the present season, early in spring, two early planted experimental plats, at Lansing, Mich., and Marion, Pa., were very seriously attacked by the Hessian fly, but on full examination carefully made at a later date, 90 per cent. of the puparia were found to have been stung by a parasite of the genus *Polygnotus* and to contain its developing larvæ. A field of wheat near Sharpsburg, Md., was found to be infested by the fly, and examination indicated the absence of the parasite. On April 8, a large number of the parasitized puparia from Marion, Pa., were brought to Sharpsburg, and placed in the field. On July 8 an examination of the Sharpsburg field showed that the parasites had taken hold to such an extent that of the large number of puparia taken and brought to the laboratory at Washington for examination, not one was found which had not been parasitized. This is the most striking example of the kind which has yet been recorded,

and indicates the value of further experimental work in this direction.

Another interesting and significant large scale experiment of this kind was carried on in the present year, also by Professor Webster, which, while void of practical results, is most significant and valuable as indicating limitations. A serious enemy of grains and grasses, an aphidid, known as the *Toxoptera graminum*, made its appearance in the winter time in Texas, and gradually appeared farther and farther north until in July it was found across the Canadian border. At certain periods this *Toxoptera* is always practically exterminated by a parasite of the genus *Lysiphlebus*. At the time when the *Lysiphlebus* in Texas is abundant, and is gaining control of the situation, the *Toxoptera* is doing its worst damage, and is comparatively unparasitized in more northern regions, such as Oklahoma and Kansas. It was considered that if the parasites could be collected in Texas in very large numbers, and transported to Oklahoma or Kansas, the introduction of these large numbers of parasites would hasten the destruction of the *Toxoptera*, remembering all the while that native-born *Lysiphlebus* in small numbers were already beginning to develop in the Oklahoma and Kansas fields. A number of experiments of this kind, and on a very large scale, were carried on; some work was done by Mr. S. J. Hunter, of Kansas, and much was published about the result of this work in the month of May; but the careful, large scale and check experiment carried on under Professor Webster in the same month seems conclusive proof of the failure of such work.

One experiment in particular may be described: On May 13 two fields of winter oats near Manhattan, Kans., each containing four acres, were selected for the experiment. These fields were sufficiently widely separated, and one of them was used as a check. Into the other was introduced some millions of parasites sent from Wellington, a point much farther south. Careful count showed that in the experimental fields the percentage of native parasitism at the beginning of the experiment was from 3 to 7. On May 18 the parasites from Wellington were introduced and liberated; on May 23 the parasitism in this field had increased only about 2 per cent., whereas in the check field, in which no parasites had been liberated, it had increased 12 per cent. On May 27 the percentage of parasitism in the field into which parasites had been introduced had reached 27 per cent., while in the check field it was 32 per cent. It was thus clearly demonstrated that even under weather conditions favorable for the development of parasites, an introduction to the extent of millions carried out under field conditions does not indicate enough efficiency to afford any encouragement for the use of this measure in the protection of the grain fields in case of future attacks.

One of the most important features which have come to the front of late, although often suggested in earlier writings, is the value of a variation in farm practise in its effect upon insect control: the rotation of crops has always been known to be of prime value, but further than this; even in the case of constant recropping upon the same land of the same growth, it is often found that slight variations in time of seeding, in time of harvesting and in method of cultivation will produce important effects upon insects and vegetation. Many of the state entomologists have taken up this line of thought, and have worked out practical results with farm insects, and also with insects that affect truck crops. The advances in this direction and in others are, in fact, so numerous that even a cursory summary would be difficult.

In the 1894 address the rise and the then

present condition of economic entomology were treated by countries, and in the United States by states. It will be well, therefore, after this consideration of the most general important developments of this application of the science, to look over the field and gain some idea of the material advances in means and facilities—in other words, let us gain some knowledge of the appreciation which our results have brought us from control bodies.

UNITED STATES

United States Department of Agriculture.—In 1894 the entomological service of the general government was carried on by the Division of Entomology, an independent division, the head of which reported directly to the Secretary of Agriculture. This office at that time carried an annual appropriation of $30,000, and its force consisted of the chief, with eight scientifically trained assistants, and three clerks and messengers.

At the time of present writing the entomological service of the department has been given bureau rank; its budget for the present year is $340,000, and its pay-roll includes one hundred scientific assistants and two hundred and fifty other employees. Its publications are numerous, and cover the whole field of economic entomology. The general appreciation of its results is most satisfactory.

The Different States.—In 1894 the state agricultural experiment stations had been in existence for six years; forty-two states and territories had employed persons to do entomological work. The number of experiment station workers who had published entomological bulletins or reports reached seventy-seven, only twenty-eight of whom were officially designated as entomologists to their respective stations. Entomological matter, mostly compiled, has been published by the agriculturists and horticulturists, and by the botanists, by the pomologists, the veterinarians and the librarians. At the present time the number of states having experiment stations and doing entomological work, including Hawaii and Porto Rico, is 51. The number of entomologists, assistant entomologists, and so on, employed by the stations is 82.

In 1894 the entomological publications of the experiment stations reached the number of 311, of which 88 were annual reports, 213 were bulletins and 10 were leaflets and circulars. In character the bulletins and such reports as had definite titles were thrown into three categories—first, those which treated only of insecticides and insecticide machinery—40; second, those which contained compiled accounts of insects, with measures for their destruction—60; third, those which contained the results of more or less sound, original observation with compiled matter, and matter upon remedies—117. There were also two small classes, one of which was apiculture, with six publications; the second, classificatory publications, of which there were four. Down to the present time the total number of entomological publications of state and agricultural experiment stations has reached 1,300, of which 424 are reports, 839 are bulletins, 34 circulars, and 3 apicultural bulletins. The stations have issued over 900 (941) reports in all, of which about one half, on a rough estimate, are entomological, or contain some entomological matters. The bulletins and circulars may be divided as follows: insecticides and machinery, 251; compiled accounts of insects, 259; more or less original observation, 356.

As the years have gone on original bulletins have increased in number. A critical summary of the results achieved by the experiment station workers would be of great interest, but it must be remembered,

as pointed out thirteen years ago, it frequently happens that compiled bulletins have a greater practical value to the constituency of the state experiment station, than the bulletins giving the results of original work. The original work bulletins advance the condition of the science; the compiled bulletins extend the knowledge of the results so as to make them more valuable to people at large. The work that has been done by the offices of the different state entomologists has been of the greatest value —Forbes, in Illinois, and Felt, in New York, have published material of the greatest value. It would be perhaps invidious to point out with any relative estimate of their value any of the many highly important publications that have been issued by the entomologists of the experimental stations; but the work done by Smith, in New Jersey, and that which he has under way in his large scale campaign against the mosquitoes of that state are of such a unique character that they force special mention. The mosquito destruction measures carried on by English workers, and especially by those connected with the Liverpool School of Tropical Medicine, in different parts of the tropics controlled by England, has been large scale work of great value. That done by the army of occupation in Cuba was of enormous value, so far as the city of Havana was concerned, and an assistant just returned from the Isthmian canal zone assures me that it is possible to sit now out-of-doors of an evening upon an unprotected veranda anywhere in the zone without being annoyed by mosquitoes, and without danger of contracting malaria or yellow fever.

These are all great pieces of work, but when we consider the condition that exists in the state of New Jersey, and the indefatigable and successful work of Smith in the handling of the most difficult problem of the species that breed in the salt marshes, and of his persistent and finally successful efforts to induce the state legislature of that wealthy but extremely economical state to appropriate a large sum of money to relieve New Jersey from its characteristically traditional pest—we must hold up our hands in admiration.

The work that has been done by the state entomologists, and the entomologists of the state agricultural experiment stations, as a whole, impresses one as being of the highest practical value. While admirable pieces of scientific investigation have been carried out, the main *facies* of the work as a whole is almost rampant with practicality. The present condition of our knowledge of insecticides and systems of inspection is due for the most part to these workers, and the reading of the reports of the meetings of the Association of Economic Entomologists can not fail to impress one, not only with the earnestness and vivid interest of these men in their work, but also of their entirely competent grasp of the subject.

The speaker has visited personally many of the European workers in economic entomology during the past five or six years, and everywhere has heard eulogistic comments upon the work of the experiment-station entomologists of the United States. Sigismond Mokschetsky said to me last May at Simferopol, in the Crimea: "I know them all—Slingerland, Smith, Forbes, Felt, Webster, Osborn—what men!"

OTHER COUNTRIES

In most of the other countries of the world conditions are so different from those in the United States as to call for a treatment differing in some degree, greater or less, from that found available in the United States. Many of the principal insect pests are cosmopolitan; many are so similar in their habits as to allow the use of identical or similar remedial measures. In each separate faunal zone, however, are

individual crop pests necessitating original observation and investigation, and frequently novel remedies. In the more newly settled countries, where agricultural holdings are large, the necessities become more nearly like those of the United States; thus, in Australia many problems are similar, and the same may be said of South Africa, and especially the new colony of the Transvaal, and the same remark may be extended in all probability to those portions of Asia which are being agriculturally developed by the Russian people. But, in the older countries, and especially in the European countries, the problem is different. In the address of thirteen years ago the speaker quoted the chief of the Agricultural Section of the Ministry of Agriculture of Prussia, who in conversation with the writer in the summer of 1893 argued that Germany does not need to employ general economic entomologists, that its experiment stations seldom receive applications for advice upon entomological topics. Special insects, it is true, occasionally spring into prominence; the phylloxera is one of these, and in an emergency like the phylloxera outbreak the work is handled by special commissions. European nations can, therefore, afford to let the problem alone to a much greater extent than the United States for the reason that it is infinitely less important with them than with us.

From several recent European visits the writer is inclined to agree, in a measure, with this statement of conditions. Nevertheless, there is a very considerable need in practically all of the countries of Europe for modern, careful work in economic entomology. A certain percentage, and it may be a very considerable percentage, of many crops is lost each year through failure to carry on entomological work on a much larger scale than it was done in 1894, or than it is done at the present date. Scattered here and there through Europe, as will appear from subsequent paragraphs, there is an occasional official economic entomologist, but, without exception, these men's hands are tied for want of financial backing. Their salaries are, without exception, extremely small from the American standpoint. They are working almost single-handed, and their opportunities are discouragingly small in face of the results that might be otherwise accomplished. They all feel these conditions strongly, and they all realize the great desirability for their government's good of additional opportunities for careful work. They are appealed to so often, in fact, by agriculturists as to indicate the certain value of added facilities, and I am convinced that practically all European governments are losing opportunities to save agriculture from a sure annual loss which may be greater or smaller, according to the conditions.

In the 1894 address the writer considered the conditions in the following countries in order: Canada, Great Britain, Germany, Austria Hungary, Italy, France, Spain, The Netherlands, Norway, Sweden, Russia (including Finland), Brazil, Chili, India, South Africa, Australia, British West Indies, New Zealand and the Hawaiian republic. In anticipation of the preparation of this address the officers in these countries just mentioned were written to with the request that they send information as to the present condition of the work in economic entomology in their countries. The same request was sent to practically all of the foreign members of the Association of Economic Entomologists. Many of them have responded, and from these responses and from personal visits to some of the countries, together with some knowledge of publications which have been issued, the following statements may be made:

CANADA

Dr. James Fletcher, in 1894 holding the position of entomologist and botanist to the Dominion Experimental Farms system of Canada, with headquarters at Ottawa, still retains the same position. At that time he worked alone. Since then he has been given two assistants. He publishes annually a report, which has constantly improved in character. The agriculture of Canada has developed enormously in the intervening thirteen years. The country has become richer, and more funds have been devoted to the Experimental Farms System. The amount that has been devoted to work in economic entomology has been by no means commensurate with the demands of the situation. As was the case in 1894, Canada is little behind the United States in her knowledge of and application of methods in economic entomology, but this is due largely to the fact of Dr. Fletcher's energy, broad grasp of the subject and indefatigability as a writer and public speaker. It is in this way that Canada, in which the agricultural conditions are quite similar to the northern portion of the United States, has been able to adopt and assimilate American methods and keep herself abreast of the times. Her problems in economic entomology, however, deserve a better support from the government than they have received. Dr. Fletcher should have opportunities for research work. He is so well informed a man, and so capable of handling problems, given greater assistance and the proper funds, that it is a pity that he has not received a greater financial support from his government.

MEXICO

No work in economic entomology was done in Mexico down to the year 1900. There was then founded a Commission of Agricultural Parasitology, which included work both with injurious insects and with plant diseases. It was placed in charge of Professor A. L. Herrera, a trained man of science, who has since remained its chief. The peculiar conditions in Mexico have caused the commission to be chiefly occupied with the vulgarization of methods already known in order to combat agricultural pests, and only recently has it been occupied in perfecting these methods where possible, having ended, to a certain extent, its labor of propagandism. It would have been illogical for the commission to have been occupied with exact studies in entomology and in investigations, while the people of the country were ignorant of the most common methods of defense, such as the Bordeaux mixture, kerosene emulsion, arsenical mixtures and so on. Professor Herrera has had to deal with an unusual class of people, and he has handled the situation with great tact and efficiency. He has published many papers of practical value, and has succeeded in spreading exact knowledge of remedies that has been of great assistance to the growers of his country.

Nevertheless, entomological investigations have been made when the necessity seemed strong. The personnel of his force consists of the chief, three traveling agents, a traveling agent charged with vaccination and the distribution of vaccine for domestic animals, a curator of collections, a designer, an entomological assistant, two bacteriological assistants, two clerks and two boys. The whole amount appropriated for all of the expense of this work, including the salaries, apparatus, etc., is $31,650.50 annually. This amount is, of course, in Mexican money, and while the Mexican dollar has a relatively small value, it has in Mexico a purchasing value equivalent to that of the American dollar. Professor Herrera keeps in constant touch with the work being done in economic entomology in other parts of the world, and with his high intel-

ligence and great scientific talents is undoubtedly one of the most valuable public servants in Mexico, and one who deserves much greater support at the hands of his government.

GREAT BRITAIN

In regard to conditions in Great Britain there have been changes since 1894. Mr. Charles Whitehead, still living at Barminghouse, Blackstone, has resigned his position as technical adviser to the Board of Agriculture, and Miss Eleanor Ormerod, for many years honorary consulting entomologist to the Royal Agricultural Society, has died. Miss Ormerod's services to British agriculture were very great and her death was a distinct loss to economic entomology. Official recognition of this science in Great Britain is slight. The Board of Agriculture, with offices at No. 4 Whitehall Place, London, does not deal with this subject in a separate branch, but it is included among the other duties of the Intelligence Division. The staff of this division consists, besides the assistant secretary, of one head, three assistant heads, five clerks and three boys. There is also a zoological adviser who is paid by the division, but the whole of whose time is not occupied by services to the board. There is no laboratory attached to the board. At present the board has no statutory powers to deal with insect infestations, except those conferred by the destructive insects act of 1877, which deals only with the Colorado beetle, but a bill to extend the powers of the board to all destructive insects is now before parliament and is expected to become a law very shortly.

The sum provided by the annual parliamentary vote for advice in economic entomology is two hundred pounds. The zoological adviser is Mr. Cecil Warburton, whose headquarters are at Cambridge, England, where he has the accommodation of a zoological laboratory and a collection of economic specimens.

There is some good economic work done at the University of Birmingham by Walter E. Collinge, and at the Southeastern Agricultural College at Wye, Kent, by Mr. F. V. Theobald. Mr. Collinge's work provides a consulting and experimental research department in connection with economic zoology, and his work includes answering inquiries from farmers, identifying farm pests, the carrying out of experiments with insecticides and fungicides, investigations in life histories of insects, lectures before agricultural and horticultural organizations, inspecting orchard and farm crops and the publication of the results. The department has been well planned, and its staff will include, when complete, a director and economic zoologist, economic mycologist and clerical or other assistants.

In the Southeastern Agricultural College at Wye economic entomology was taken up in 1894. Mr. Theobald was appointed in charge, and he has since carried the work along with the help of senior students only. Mr. Theobald has a good laboratory and equipment and has a large advisory correspondence from all parts of the kingdom and empire. He publishes an annual report and lectures before farmers' clubs and at definite agricultural centers. The college at Wye trains many students in agriculture from all parts of the British empire. The result is that Mr. Theobald lectures upon tropical insects as well as upon the insects of Great Britain. Some of these graduate students have been sent out to the colonies to take charge of entomological work, and inasmuch as this work will not receive especial consideration in this address, it might be well to mention that Mr. Harold H. King has been made the entomologist to the Sudan government; Mr. Frank Wilcox has been appointed entomologist to the Khedival Agricultural

Society at Cairo, Egypt, and Mr. C. W. Mason has received an appointment in the Imperial Department of Agriculture in India. The work, however, by reason of which Mr. Theobald is most prominent in the eyes of the scientific world at present is his great monograph of the mosquitoes of the world, of which four volumes, and one volume of plates, have already been published under the auspices of the British Museum of Natural History for the immediate purpose of enabling investigators of the transfer of disease by insects to determine the culicids under investigation. From 1901 to 1904 Mr. Theobald was superintendent of the short-lived department of economic zoology of the British Museum of Natural History.

The establishment within a year or two of the Association of Economic Biologists in England, and the founding of the *Journal of Economic Biology,* should be mentioned as important steps in the work in economic zoology in England. Another important step has been the appointment of Mr. R. Newstead to the School of Tropical Medicine at Liverpool. The necessity of this appointment was early seen by Professor Rupert Boyce, Sir Patrick Manson and Dr. Ronald Ross, and in fact Mr. Newstead's appointment was the first of its nature that has been made to an institution for medical research following the discovery of the tremendous importance of insects in the carriage of disease. It may be incidentally mentioned that at about the same time the writer was appointed consulting entomologist to the Public Health and Marine Hospital Service of the United States for the same reason. At Liverpool Mr. Newstead has excellent laboratory facilities in the famous Thompson-Yeates laboratories, gives lectures upon entomology and does the whole strictly entomological work connected with the most important investigations being carried on under that admirable institution.

IRELAND

As I am informed by Mr. George H. Carpenter, of Dublin, a great advance in the work of economic entomology in Ireland resulted from the establishment of the government department of agriculture and instruction in 1900. To this department were then transferred many of the scientific institutions of Dublin where biological research was carried on, including the Museum of Science and Art and the Royal College of Science. The museum staff to which Mr. Carpenter belonged, as stated in the 1894 address, was in the habit of receiving and answering inquiries about injurious insects, and with the establishment of the department the number of these inquiries increased. Popular leaflets on common insect pests were drawn up upon request for the use of farmers throughout the country. In 1901 Mr. Carpenter was appointed lecturer on zoology at the Royal College of Science for Ireland, and entomology forms an important feature of the zoological course. In 1904 he was made a professor in the college. He now possesses good laboratory facilities and funds for the purchase of material. Mr. Carpenter still retains the post of consulting entomologist to the Royal Dublin Society, which has issued economic proceedings since 1901, and these have formed an excellent channel for the publication of Mr. Carpenter's yearly reviews of injurious animals of Ireland. One feature of the work of the Dublin Museum which it is said has been shown to be valuable is the preparation of small collections of injurious insects for circulation in schools and elsewhere throughout the country.

GERMANY

Conditions have not changed to any great degree in Germany in the past thir-

teen years. Dr. Holrung still remains director of the station in Halle, where he has excellent laboratory facilities, and an insectary for experimental work. At the Forest School at Tharandt excellent instruction in regard to forest entomology is given, and there is carried on a large correspondence with foresters and proprietors of estates throughout the empire. The entomologist at Tharandt is Mr. Behr. Dr. Arnold Jacoby, the former professor of zoology, has been appointed director of the zoological and ethnological museum at Dresden, and no longer gives his attention to forest zoology. He has been succeeded by Dr. Escherich.

At Eberswalde bei Berlin the Forest School is active under the charge of Dr. Eckstein, who takes a vivid interest in matters relating to forest zoology. Visiting this school in May of the present year, the writer was delighted to find the old collections of Ratzeburg preserved in the most excellent condition, and his types receiving admirable care. Questions of agricultural entomology are referred to these three stations and others, but there are no especial institutions for the investigation of the life histories of injurious insects.

The conditions that exist in Germany hold for Austria.

HUNGARY

As stated in 1894, the Royal Entomological Station at Budapest, then under the direction of Dr. Geza Horvath, was founded by the government in 1881 as a phylloxera station, and as the phylloxera problem became more and more elucidated, and the means of defense against the scourge was reduced to a practical basis, the work of the station became directed more and more towards noxious insects in general and thus became an official bureau of investigation in economic entomology, a result due to Dr. Horvath's administration and to the wisdom of the Hungarian government. Since the last address Dr. Horvath has resigned his position to accept the post of director of the Royal Natural History Museum in Budapest, and has been succeeded in charge of the Entomological Station by his able assistant, Professor Josef Jablonowski, who at present has admirably fitted offices in the viticultural station, some three miles from Pesth, and with a small corps of assistants is doing most excellent work. He has been devoting much of his attention of late to the insects injurious to the sugar beet, and to the invasions of locusts into Hungary from the south. Professor Jablonowski is an admirably informed man, and it is due to his suggestion that the writer introduced upon a very large scale the wintering nests of the brown-tail moth into Massachusetts. Prior to this suggestion it was not known or expected that these newly hatched hibernating larvæ would contain parasites; but such is the fact, and hundreds of thousands of these parasites have emerged from introduced nests in Massachusetts, and are probably breeding here now.

ITALY

In 1894 the Royal Station of Agricultural Entomology at Florence was directed by Professor Adolfo Targioni-Tozzetti, assisted by Dr. Giacomo del Guercio and Professor Antonio Berlese. Since that time there have been changes. Professor Berlese went to Portici, near Naples, to take the professorship of economic zoology in the Royal Agricultural School. While there, with the assistance of Dr. Filippo Silvestri and Dr. G. Leonardi, he did some of the best work that has been done in entomology in general, and in its application to agriculture. His publications have covered a wide field, and were admirably and thoroughly done

at the expense of great labor, and with very slight remuneration from the government. With the death of Professor Targioni-Tozzetti in 1902, Professor Berlese was made Director of the Royal Station for Agricultural Entomology at Florence, and Professor Silvestri succeeded him in the chair at Portici, the latter retaining Dr. Leonardi as his principal assistant. The technical staff of the Entomological Station at Florence is now as follows: Director, Professor A. Berlese; assistants, Professor G. del Guercio and Dr. C. Ribaga; in addition Dr. Paoli is engaged for work against the olive fly, and there is a subordinate staff which consists of a curator, a preparator, a mechanic and a gardener. The funds for the carrying on of the station amount to 16,000 lire per annum. In addition to these funds the government provides separate sums for experiments in different parts of the country, and for study in the different provinces, and sometimes these funds are large. Just at present large appropriations have been made for the study of the olive fly, and means to combat it. The station is intensely occupied with this problem at the present time, and field experiments are being made in various parts of the olive regions of the kingdom. Professor Berlese informs the writer that in Maremma in Tuscany the results already are satisfactory, and this year it is expected that the work will be completed.

At Portici the work includes instruction in entomology, experimental work in cooperation with the station at Florence, and a great deal of original work of the highest character is being carried on by both Silvestri and Leonardi. The force consists of these two men, Professor Silvestri being director, as previously stated, another assistant, Dr. G. Martelli, and a preparator. The laboratories at Portici are commodious, and the historic old palace in which they are situated is surrounded with beautiful gardens.

FRANCE

In 1894 a Department of Agricultural Entomology had just been founded at the Agronomical Institute at Paris. This office has since been termed the entomological station, and Dr. Paul Marchal has been at its head working under the Ministry of Agriculture.

The headquarters of the station are still at the National Agronomical Institute, No. 16 Rue Claude Bernard. Dr. Marchal is well equipped for the important work upon which he is engaged; but he has but one assistant, who is not a scientific man, but whom he has trained himself to act as a preparator; he has one small room and two halls; no experimental field, the most of his observations having been carried on in his home garden in the suburbs of Paris, where his rearing cages are established. Dr. Marchal is also professor of zoology as applied to agriculture in the Agronomical Institute, and in this work he has a tutor (Monsieur Grénaux) who is busy with the students in the preparation for their examinations, and in the arrangement of their courses. As professor of zoology Dr. Marchal gives thirty courses, one and one half hour each, twice a week from October 15 to February 15. The greater part of these courses is reserved for insects; three lessons are given to silk culture; three to bee culture, and one to oyster culture. There are a special lecturer on fish culture, and a professor of zootechny. The work that has been accomplished by Dr. Marchal under these adverse circumstances is remarkable, his latest labors resulting in the establishment of the phenomenon of *polyembryony* in certain parasitic insects are of profound scientific value, and, as we have already found in this country, possess a most im-

portant practical bearing upon the use of parasites.

Other work in economic entomology is carried on in France under the government at several points. Professor Valery Mayet at the National Agricultural School at Montpellier still teaches economic entomology, and continues his experimental work. Here, however, is the same old story; insufficient laboratory space, and not even a single assistant; half of the time of one assistant only.

At Rennes Professor C. Houlbert also teaches economic entomology in connection with his work at the University at Rennes. At Rouen Professor Paul Noel is chief of a small station for economic entomology, supported in part by the government, and in part by the department. Here he conducts investigations of the insects of that region, has built up a large collection, and is the consulting entomologist for the agriculturists of his department.

In her north African colonies France has met with a serious problem in the invasion of locusts and crickets from the south, and has conducted for a number of years an extensive investigation that has culminated in the publication of an enormous volume of the greatest interest, prepared under the direction of the director of the work, Professor J. Künckel d'Herculais.

THE NETHERLANDS

Professor J. Ritzema Bos is still the economic entomologist of Holland. Down to 1906 he conducted a phyto-pathological laboratory in Amsterdam; this was a private institution, but had received grants from the treasury, and really constituted the governmental service in this direction for the Netherlands. In 1902 the speaker visited this laboratory, and found it well located, with interesting collections. In 1906, however, the government opened an institution for phyto-pathology in connection with the agricultural college at Wageningen. The old laboratory in Amsterdam still exists as a small private institution. The work of the new institution is in the hands of the director, who has one assistant, one temporary assistant, an amanuensis and a laborer. Their work covers every part of phyto-pathology, as well in entomology as in mycology, in relation to agriculture, horticulture and silviculture; and under this office is done the inspection work of the government.

In her East Indian colonies the Netherlandish government has done some very good work in economic entomology in the investigation of the insects injurious to sugar cane; the insect enemies and diseases of this important crop in Java have been studied with care at the Dutch experiment stations, and excellent reports have been published.

NORWAY AND SWEDEN

In these two countries the conditions have not changed, and the work goes on about as described in 1894.

BELGIUM

Belgium has long been the home of many well-known entomologists, and in the publications of the Entomological Society of Belgium are to be found many papers of interest from the standpoint of economic entomology. The administration and the Superior Council of the Forests of Belgium have been occupied for a number of years with a condition involving an unusual development of insects injurious to wooded properties and domains, and Professor G. Severin, curator of the Royal Natural History Museum of Brussels, has been officially charged by the Belgian government to study this especial situation in order to propose remedies. Professor Severin is a man of great acquirements in natural history in general, as well as a trained ento-

mologist, and his work in this direction can not fail to be of great value to his government.

There is in Belgium an entomological service of the State Agricultural Institute, and in the Bulletin de l'Agriculture, Part II., 1907, there appears a long article upon the observations of this service for 1906, by Professor Poskin. In this report is given a comprehensive account of the whole subject of insecticides.

RUSSIA

In Russia rather more work is being done than in most of the other European countries. The necessity for work in economic entomology in this country is greater than in the small countries, as pointed out in a previous paragraph. Under the direct charge of Professor J. Portschinsky, of the Ministry of Agriculture, stations have been established in different parts of the empire where entomological work of considerable value is being carried on.

During the present year the speaker has visited three of these stations, one at Kieff in the province of Kieff, under the charge of Professor Waldemar Pospielow; one at Kischeneff in Bessarabia, under the charge of Professor Isaac Krassiltchik; and one at Simferopol in the Crimea, under the charge of Professor Sigismond Mokschetsky. All of these men are trained observers, and are doing excellent work.

Professor Pospielow is connected with the University at Kieff, and is known for his researches on the influence of certain physical conditions upon the color of *lepidoptera*. Professor Krassiltchik has a private station in Kischeneff; Professor Mokschetsky is the director of the museum of natural history in Simferopol, an institution which he has built up by his own labors. He has conducted many investigations in economic entomology, and has published a number of papers of value. Entirely through his influence the Crimea, a most fertile country, in which great attention is devoted to fruit growing, was perhaps the earliest locality in Europe in which American ideas in economic entomology were introduced. It was most interesting to walk, as I did on several occasions, through enormous orchards and see everywhere American spraying machinery, and see the crops in as good condition as they could possibly be found in the most up-to-date region in the United States.

There are other similar stations subsidized by the government in different parts of Russia, and the problem of injurious insects is handled with intelligence, with a full knowledge of what has been done in other countries, and with much ingenuity.

In addition there is at St. Petersburg a zoological laboratory and museum under the Royal Institute of Forestry, of which Professor M. Cholodkowsky, a man of high ability, is director. He has two assistants and handles all matters relating to forest zoology. The assistants are Head Forester A. Ssilantjew, and Head Forester P. Spessiwzew.

FINLAND

This administrative province of Russia had made an attempt at the time of the writing of the last address to secure the establishment of an entomological experiment station. This attempt later proved to be successful. For some years the most advanced agricultural instruction has been given at the University at Helsingfors, where economic entomology is represented by a special teacher who gives regular courses of lectures, is at the head of a special laboratory, is the government entomologist, and as such is the head of the entomological department of the agricultural experiment station. This institution thus far has had only provisional

quarters, but will be more fully organized and equipped in the autumn of 1908. In the new building to be erected ample laboratory space will be given, and a spacious insectary will be erected, with an isolated building for fumigation experiments. Professor Enzio Reuter, a well-known writer on economic entomology, is in charge of this work in Finland; and with the additional facilities expected there are sure to be more than commensurate results of practical value.

SOUTH AMERICA

Outside of the field of the investigation of mosquitoes, excellent work on which has been done by Dr. Lutz and Dr. Goeldi of Brazil, the situation is much the same as it was in 1894. Since that time, however, an important investigation of the locust ravages in Argentina was made by a North American entomologist, Professor Lawrence Bruner, whose expenses were paid by an association of merchants in Buenos Ayres. An admirable report was published, which does credit to American entomology. Subsequently the well known French entomologist, Professor J. Künckel d'Herculais, was employed to continue these investigations, which he did with the success to be expected.

Quite recently the government of Chile has undertaken systematic work in economic entomology, and has appointed a young native scientific man, Professor M. Rivera, professor of entomology at the Santiago Agricultural School, to take charge of this work, and to establish a government research laboratory at Santiago. Professor Rivera has just visited Europe and is at present in the United States, informing himself as to methods, books, machinery and equipment, and is arranging for an exchange of useful insects between Chile and the other countries.

In the 1894 address the important earlier work of Mr. Edwyn C. Reed was mentioned and it is interesting to note that at the present time his second son, Mr. Charles S. Reed, natural-history professor at the Concepcion Agricultural and at other colleges, is interesting himself in economic entomology. He has written several pamphlets on noxious insects and on Chilean birds that have been published at his own expense.

SOUTH AFRICA

Great progress has been made in this part of the world since the publication of the last address. In 1895 Mr. C. P. Lounsbury, of Massachusetts, was appointed entomologist to the government of the Cape Colony. His work was excellent from the start. He has conducted investigations of a high value to the colony, and to the whole of South Africa. Governmental confidence in his ability has been shown by increased facilities; he now has four assistants, a clerk, five hands for rough work, and various other assistants when needed; this is for the ordinary work of the office. In addition legislative action provides for nursery inspection and restrictions on the transportation of plants, and in other directions. The animal diseases experiment station is entirely under the charge of the office, and sums have been appropriated for locust destruction. The work done by Mr. Lounsbury has been of most varied character, and of the most excellent quality; his investigation of the South African ticks has been of striking value, and a model for investigators in other parts of the world.

In Natal Mr. Claude Fuller ranks as government entomologist and chief locust officer; he is also a chief inspector under the plant diseases act, and the officer administering the burr-weeds and Scotch-thistle exterminating acts. He has two assistants, Mr. A. E. Kelley and Mr. von

Pelser Berensberg. Mr. Berensberg is located at Durban, and is port examining officer, inspecting and treating all shipments of fruit and fruit trees and plants entering the port for Natal and the inland colonies. The laboratory facilities are poor, but excellent work has been done by Mr. Fuller and his force.

In the newly established colony of the Transvaal a department of agriculture was immediately established, and Mr. C. B. Simpson, of the force of the Bureau of Entomology at Washington, was sent out to take the appointment as entomologist. Mr. Simpson did excellent work from the very outset; he took hold of the problems existing—and some of them were very serious—with energy, enthusiasm and tact beyond praise. His success was great; he secured the confidence of his constituency at once; he was given assistance; he conducted investigations on the ordinary crop pests, upon the malarial mosquitoes, and finally was given a large sum, amounting to $60,000, for locust destruction. In this destruction work he was very successful; in fact, it seems safe to say that his work in this direction was the most important that has ever been done against insects of this class. His death from typhoid fever, which occurred in the autumn of 1906, was a great loss to the Transvaal, and a great loss to economic entomology. I have not learned that his successor has been appointed, but whoever he is, or may be, he will find, or will have found, that his work has been made easy for him by the labors of Simpson.

AUSTRALIA

The Australian states of Victoria, New South Wales, Queensland, South Australia and Tasmania have all continued to interest themselves to a very considerable extent in economic entomology; and Western Australia has taken up the problem, though in quite a different way.

In Victoria Mr. Charles French continues to hold the office of entomologist to the government and continues his excellent work, publishing from time to time upon insects injurious to vegetation. His handbook on the "Destructive Insects of Victoria," of which the first part was published in 1891 and the second in 1893, has been continued; and the third part, published in 1903, in addition to injurious insects takes up the consideration of certain valuable insect-destroying birds.

In Tasmania the work was continued until comparatively recently, but I have heard nothing in the last few years from that state.

In South Australia Mr. J. G. O. Tepper, in charge of the entomological department of the South Australia Museum, has acted as consulting entomologist for the agriculture department, although he is not now officially connected with the subject of applied entomology in that state. In 1894 Mr. George Quinn, horticultural instructor and chief inspector of fruit under the so-called "vine, fruit and vegetable protection act," became connected with the department of agriculture for the purpose of carrying out the law and trying in a general way to place horticulture on a sound footing. This law empowered the authorities to deal with, and regulate, the introduction into the state of fruits, plants, insects and diseases, and to make regulations for enforcing attention to any which might be already found injuring plant life in the state, or which might from time to time be introduced into the state. The law has been enforced in regard to the codling moth and the red scale, and a system of supervision has gradually been initiated over all the imported fruits and plants. They have prohibited the introduction of grape vines or portions thereof, and have set aside Adelaide as the sole port of entry of fruits and plants. Plants sent by

parcels post are inspected and examined. Disinfection by hydrocyanic acid gas is carried on and charges are imposed on the importer covering the expenses incurred. Demonstrations and spraying experiments have been carried on in the orchards and gardens of South Australia under Mr. Quinn's direction, and much work has been done during the last ten years in testing remedies, publishing bulletins, and in giving lectures and personal advice. Mr. Quinn has three permanent assistants dealing with exports and imports. Moreover, about nine inspectors for orchard districts have been and will be employed. These men are selected from the best informed fruit growers in each district and are employed about six months in the year. Mr. Quinn also acts an instructor in horticultural matters and expends in his branch of the service about $8,000 a year.

In New South Wales, Mr. W. W. Froggatt on the death of Mr. A. Sidney Olliff was appointed government entomologist and attends to all of the correspondence on that subject, travels through the state making investigations, lectures on economic entomology, has an insectary where the necessary breeding tests are carried on, and has a laboratory and office in Sydney. The results of his investigations are detailed in articles published in the *New South Wales Agricultural Gazette*, and a short annual report is also published in the *Gazette*. Mr. Froggatt left New South Wales as a representative of the whole Australian federation with letters of introduction from the different premiers and the different departments of agriculture of the individual states, on the eighth of July, last, for a visit to the United States and other countries. He is an admirably equipped man of broad knowledge in the whole field of natural history and has achieved admirable results in his investigations. His recently published volume on "Australian Insects" shows his very competent grasp of the subject and his industry as a worker.

At the Hawkesbury Agricultural College in New South Wales—a government institution under the department of agriculture—economic entomology is dealt with as one of the subjects, and a course of thirty-two lectures and fifteen practical exercises is gone through during the second year of the student's residence. The work covers instruction in insect structure, chief pests, useful insects and treatment, the latter being well illustrated in practise by orchard operations carried on in an up-to-date manner. This work is under the charge of Professor Charles T. Musson, who, however, covers in his work botany, vegetable pathology and nature study, with one general assistant.

During the past year a bill passed the New South Wales Legislature giving power to enforce certain action relative to the codling moth and fruit fly, and inspectors to carry out the work have been appointed. The fruit expert of the department carries on a good deal of work in fumigation and spraying, mostly for demonstration and instruction purposes in the course of his travels throughout the state, and the subject is being introduced into the schools as a part of nature study.

In Queensland Mr. Henry Tryon, whose excellent publications are well known to American entomologists, is still connected with the department of agriculture as entomologist and vegetable pathologist, as well as inspector under the diseases of plants act. He supervises all plant importations and exportations, and has no assistants. His offices are in the department of agriculture in the center of the city of Brisbane, and he has slight opportunity for field experimentation. At the time of the last address Mr. Tryon was an assistant curator in the Queensland Museum, but

was appointed to the department of agriculture in 1895.

In Western Australia the entomological work is done largely by Mr. George Compere, who acts in the dual capacity of expert of the department of agriculture, and as a traveling agent of the state board of horticulture of California. Mr. Compere is an enthusiastic believer in the efficacy of introduced parasites, and pays slight attention to other remedial measures.

BRITISH WEST INDIES

The situation in the British West Indies has changed radically since the publication of the former address. The Imperial Department of Agriculture for the West Indies was organized in 1898, and Sir Daniel Morris was appointed commissioner. The department was originally established for ten years, but has since been extended for a further period of five years; that is to say, until October 1, 1913.

During 1899 an entomologist was appointed, Mr. H. Maxwell Lefroy, who has since been transferred to India. Mr. Henry A. Ballou, of Massachusetts, was appointed to succeed him in March, 1903; he has no assistants beyond a single preparator. Mr. Ballou has done good work in investigating injurious insects of the territory over which the department extends, and publishes entomological information in the various periodicals and reports of the department, as well as in a fortnightly review, known as the *Agricultural News,* which contains popular insect notes. More technical papers appear in the *West Indian Bulletin,* a quarterly journal.

In the British Atlantic Islands outside of the control of the Imperial Department of Agriculture, such as Bermuda and the Bahamas, no official work in economic entomology seems to be carried on. In Bermuda, however, at the present time, under the agricultural society of the island, a most interesting experiment is under way, as I am informed by Mr. Ambrose Goslin the president of the society, and Mr. Claude W. McCallan, an old correspondent of the Bureau of Entomology at Washington. The fruit fly of Bermuda and other places (*Ceratitis capitata* Wied.), referred to in a short illustrated article in *Insect Life,* Vol. III., pp. 5–8 (1890), has increased so greatly and has become so injurious as to warrant the most radical means of destruction. During the present year all fruit of the island known to be affected by this insect has been rigorously destroyed in the effort to leave not a single opportunity for the insect to breed this year. This is an effort at extermination and its results will be followed with the greatest interest by all persons interested in entomology and fruit culture. The only comparable experiment known to the writer was carried on some years ago in a very large but isolated and most remunerative apple orchard in South Idaho when the entire crop is said to have been destroyed for one season, with the result that the codling moth in that region was exterminated.

INDIA

In India in 1894 the principal work in economic entomology had been done by Mr. E. C. Cotes, in charge of the entomological collections of the Indian Museum in Calcutta. Some three volumes of the valuable *Indian Museum Notes* had been published at that time, and a number of special reports had also been sent out dealing with economic problems in entomology. Since Mr. Cotes's retirement the work has been continued, and although the important *Indian Museum Notes* have not been issued so frequently, they are still published. There have, however, grown up two important branches of entomological service—the one established in 1901, when Mr. E. P.

Stebbing was appointed forest entomologist to the government of India; and the other in 1903, when Mr. H. Maxwell Lefroy was appointed entomologist to the government of India, or, as appears from his later reports, "Imperial Entomologist," leaving his position in the British West Indies to be succeeded, as is shown elsewhere, by Mr. H. A. Ballou. By Mr. Stebbing have been published a series of circulars on agricultural economic entomology issued by the trustees of the Indian Museum. Under Mr. Maxwell Lefroy has been started an entomological series of the memoirs of the Department of Agriculture in India, beginning with April, 1906. Five numbers have appeared, the last one bearing the date June, 1907. Mr. Stebbing has also published certain forest bulletins dealing with tree-boring beetles. In addition to these appointments, Mr. E. Ernest Green, well known for his able studies on the Coccidæ, has been made government entomologist for Ceylon with headquarters at the Royal Botanic Garden at Peradenyia, Ceylon, an admirable step and an appointment which Mr. Green can not fail to fill in the most satisfactory manner.

CONCLUSION

Looking over the whole field, it becomes obvious that very great advances have been made in economic entomology in the last thirteen years; greater advances, in fact, than during the entire previous history of the study. It becomes obvious, also, that the greatest advances have been made in the United States of America. In spite of this fact, however, it is plain that the United States is behind most of the other countries of the world in one most important particular.

Six years ago, visiting Hamburg, I found a most perfect system of inspection of all foreign fruits, trees and fruit products in operation. Nothing containing or carrying an insect was allowed to enter Germany through that port. To-day this holds true of most other countries. Even in the colony of Natal, as has been pointed out, there is a qualified agent stationed permanently at Durban, and his work protects Natal and the inland colonies from invasion by new insect pests and new plant diseases from abroad.

In the United States we have no such protection, except the one port of San Francisco, where under the state law, that has been upheld in the courts, California is protected. A crying need in this country is the passage of a general quarantine act by which the other great seaports of the United States should be protected.

L. O. HOWARD

SCIENTIFIC BOOKS

A Text-book of Organic Chemistry. By A. F. HOLLEMAN, Ph.D., F.R.A. (Amst.), Professor Ordinarius in the University of Amsterdam. Translated from the third Dutch edition by A. JAMIESON WALKER, Ph.D., B.A., head of the Department of Chemistry, Technical College, Derby, England, assisted by OWEN MOTT, Ph.D., with the cooperation of the author. Second English edition, rewritten. New York, John Wiley and Sons. 1907. Pp. 589. $2.50.

Walker's first translation of Holleman's "Organic Chemistry" was published in 1903. It met with so favorable a reception that a reprint was made, while Walker was translating the present edition.

This book differs from other larger text-books of organic chemistry in the restriction of the field by the omission of a great number of isolated compounds, and by the prominence given to theory. In the words of the author "this book is essentially a text-book and makes no attempt to be a 'Beilstein' in a very compressed form."

Thanks to the limitation of the field, the student's attention is fixed on the more important classes of organic compounds, and on

the theory of their formation, structure and decomposition. A student who has mastered this book should find it an easy matter to gradually enlarge his knowledge by study of some larger book and by reading chemical literature and journals.

That the book is thoroughly revised and brought up to date is shown by the references to the work of Baeyer and Villiger and Collie and Tickle on oxonium compounds, of Thiele on partial valence, of Ciamician on pyrrol, of Emil Fischer on amino acids, and by the application of physical chemistry where it serves to explain reactions, as in the formation and saponification of esters.

The reviewer feels no hesitation in recommending this book as one of the best text-books—perhaps it is *the* best—extant for those students for whom it was written, students of chemistry. It is not suited to students in high schools or colleges or to medical students who are "taking a course" in organic chemistry.

E. Renouf

Die Spiele der Tiere. Karl Groos. 2 Aufl. Jena, G. Fischer. 1907. Pp. viii + 341.

This new edition is apparently different from the first chiefly in the changes that were necessary to make it appeal to the lay reader. This impression is given by its appearance in German type, and the omission of a considerable amount of theoretical discussion. The anecdotes and instances cited are almost identical with those of the first edition. The only important change in theoretical standpoint is with reference to imitation. In the former edition Groos followed James Mill and current tradition in regarding imitation as an instinct. In the present edition he takes the ground that it must rest upon individual acquirement and presupposes practise based on experimentation. Instincts imply definite reactions to definite stimuli, while imitative movements are essentially variable in response to many different stimuli. The tendency to imitate, however, is made to rest upon an inherited disposition. The only considerable change in text is found in the concluding chapter, which has been reduced about three quarters, by the omission of all controversial matter and expository statement of theories. In this edition the author limits himself to the statement of his conclusions, that play is a form of experimentation, derives its pleasure from the feeling of power in self-activity, or from self-exhibition, and is closely related to the esthetic impulses of mankind.

W. B. Pillsbury

University of Michigan

SCIENTIFIC JOURNALS AND ARTICLES

The New York Zoological Society has issued the first of a series of papers which will appear from time to time and give the results of the scientific work carried on by members of its staff. The title of the publication is, or was to have been *Zoologica,* but by an error it appears as *Zoologia.* This reminds one of the German University that proposed to issue an absolutely perfect *Festschrift,* and did issue it with a glaring error on the title page. A somewhat similar mistake recently occurred in a number of the *Bulletin of the American Museum of Natural History,* where the name of the author was misspelled.

The Museums Journal of Great Britain for October contains articles "On Preparing Artificial Ground-work for Mounting Individual Specimens, Economic Sets, etc., in Spirit," and "A Method of Utilizing Small Wall-areas in Museums for Spirit Preparations," by F. G. Pearcey, and "The Aims and Objects of Museums," and especially the Western Australian Museum, by B. H. Woodward.

A *Bulletin* on "Unutilized Fishes and their Relation to the Fishing Industries," by Irving A. Field, has just been issued by the Bureau of Fisheries. This contains some important observations on the food of the smooth dogfish, *Mustelus canis,* and horned dogfish, *Squalus acanthias,* showing that one is extremely destructive to lobsters and the other to the more important food fishes. Incidentally, attention is called to the fact that the numbers of edible fishes have been greatly lessened, nothing has been done to destroy their enemies, which have increased.

SOCIETIES AND ACADEMIES

THE AMERICAN CHEMICAL SOCIETY—NEW YORK SECTION

THE second regular meeting of the session of 1906–7 was held at the Chemists' Club, 108 West 55th Street, on November 8.

The following resolutions respecting the proper interpretation of the measures enacted in the federal pure food and drug law were adopted:

WHEREAS: The Food and Drugs Act of June 30, 1906, is generally approved, and in the opinion of the New York Section of the American Chemical Society it is one of the most important measures which has been taken for the protection of the public; and

WHEREAS, on the other hand, we can not but feel that the rules and regulations published from time to time by the Department of Agriculture, for carrying out the provisions of this act are not in full accord with the knowledge and experience of some of the members of this section, who are experts in these matters, and inasmuch as there is a conscientious difference of opinion concerning the same, therefore be it

Resolved, That we respectfully request the honorable Secretaries of Agriculture, the Treasury and Commerce and Labor, who are given the authority to administer this law, to suspend the publication of these decisions temporarily, and before taking further steps in this direction to consult with a carefully-selected committee of experienced chemical manufacturers and scientists, recognized as authorities in these fields.

The following papers were read:

The Atomic Weight of Chlorine: W. A. NOYES and H. C. P. WEBER.

The Effect of Coal Gas on the Corrosion of Wrought-iron Pipe buried in the Earth: W. L. DUDLEY.

This investigation was undertaken in connection with a study of the conditions causing the corrosion of pipe laid under the streets of Nashville.

Five samples of earth were collected as representative of the various types of earth in which the pipes are laid. The samples were analyzed for chlorin, nitrogen as nitrates, nitrites and ammonia, alkalinity and humus. Each sample was put in a separate wooden box. Five pieces of wrought-iron pipe were cleaned by immersing in a warm ammoniacal solution of ammonium citrate, washed in water, dried and weighed. Each piece was tightly plugged at one end and thrust into a box of earth. The pipes were left in contact with the earth for twelve months, during which time water was occasionally added in equal amount to each box. At the end of this time the pipes were removed, cleaned as before and weighed. A similar set of boxes and pipes were left for twelve months, during which time one half cubic foot of coal gas was admitted to each box daily. Each box of this set was moistened daily with 50 c.c. of water, the boxes being covered with canvas to prevent evaporation.

The loss of weight of the set of pipes in contact with coal gas was found to be about one half as great as in the case of the pipes immersed in the earth alone. In both cases the loss was greater in the earth containing the greater chlorine content.

Chemical Examination of Micromeria Chamissonis (Yerba Buena): F. B. POWERS and A. H. SALWAY.

When the entire air-dried plant was distilled with steam, 0.16 per cent. essential oil and a little palmitic acid passed over. The oil had a mint-like odor, sp.g. 0.9244 at 20°, $[\alpha]_D = -22° 48'$.

The concentrated alcoholic extract of the plant, a thick, green oil, was distilled with steam. The distillate contained traces of formic, acetic and butyric acids and an essential oil: B.P.$_{25}$ 80–160°, sp.g. = 0.9450 at 20°, $[\alpha]_D = -26° 44'$. The residue in the still separated into a red aqueous liquid and a soft resin. From the aqueous liquid were obtained a new alcohol, *xanthomicrol*, $C_{15}H_{12}O_6$, yellow needles, m. 225°, with phenolic properties, and i-glucose. A petrol-ether extract of the resin gave a paraffine $C_{31}H_{64}$, a phytosterol $C_{27}H_{46}O$ and behenic, arachidic and palmitic acids. From the ether extract of the resin two new alcohols, *micromerol* $C_{32}H_{56}O_6$ and *micromeritol* $C_{30}H_{50}O_6$, were isolated. Micromerol, m. 277°, very stable, occurs to the extent of 0.25 per cent. of the plant. It forms a

monoacetyl and a monomethyl derivative, and is physiologically inactive. Micromeritol, m. 294–296°, gives a diacetyl and a monoacetyl derivative.

C. M. Joyce,
Secretary

THE TORREY BOTANICAL CLUB

The meeting of October 30, 1907, was held in the Museum Building of the New York Botanical Garden. The club was called to order by the secretary at 3:55 o'clock P.M., and Dr. John Hendley Barnhart was elected chairman. Twenty-two persons attended.

The following program was presented:

Botanical Exploration in Jamaica: N. L. Britton.

Dr. Britton described his recent trip to the island of Jamaica, where he spent the month of September, with Mrs. Britton, and in cooperation with Hon. William Fawcett, director of public gardens and plantations, and of Mr. William Harris, superintendent of public gardens, in exploring the south-central portion of Jamaica. Collections aggregating about one thousand field numbers were made in the vicinity of Kingston, in the vicinity of Mandeville, on the Santa Cruz Mountains and the Pedro plains, lying between these mountains and the southern coast; the coast and morasses about Black River and Lacovia were examined, and another base was made at New Market on the western border of the parish of St. Elizabeth, whence the hill country of the vicinity and of Eastern Westmoreland were explored; a stop was also made at Bluefields on the southern coast.

The region explored had been little collected in since the visit of William Purdie, an English collector sent to Jamaica from the Royal Gardens, Kew, in 1843 and 1844, and many species not collected by Mr. Harris in his recent work were obtained. Specimens of a considerable number of the more interesting trees and shrubs obtained were exhibited.

Remarks on the water-weed, Philotria: P. A. Rydberg.

The genus was first described in Michaux's Flora Boreali-Americana under the name Elodea. Unfortunately this is antedated by *Elodes* Adanson. *Elodea* is characterized as having hermaphrodite flowers with three stamens and three bifid styles. Muhlenberg in his catalogue referred the plant to the Old World *Serpicula verticillata* L., now *Hydrilla verticillata,* and characterized the plant as being diœcious with four-merous staminate flowers. Pursh in his "Flora" retains the plant in *Serpicula,* but publishes it under a new specific name, *S. occidentalis.* His description agrees in every respect with that of Michaux except that the leaves are described as linear, acute, and finely serrulate. Rafinesque, in reviewing Pursh's "Flora" in the *American Monthly Magazine* criticized Pursh's treatment of the plant and proposes a new name *Philotria,* under which the plant is now to be known. Nuttall in his genera proposes another new name *Udora,* and cites *Elodea* Michx. as a synonym; but describes the plant as being diœcious, the staminate flowers as having nine stamens and the pistillate as having three sterile filaments and three ligulate bifid stigmas. He also adds: "flowers very small and evanescent, the female emerging; the male migratory, breaking off connection usually with the parent plant, it instantly expands to the light, the anthers also burst with elasticity and the granular pollen vaguely floats upon the surface of the water." Torrey, in the "Flora of New York," describes *Udora* as being polygamous; the sterile flowers with nine stamens, the fertile ones with three–six stamens and cuneiform, two-lobed stigmas.

How are these conflicting descriptions to be reconciled? Have some of the authors mentioned given erroneous descriptions? Are there more than one species which have been confused, or is *Philotria canadensis* such a variable plant both as to flowers and leaves? If there are more than one species, are they all polygamo-diœcious with three kinds of flowers: staminate with very short perianth-tube and nine stamens, pistillate ones with long tube and no stamens or merely rudimentary filaments, and hermaphrodite flowers similar to the pistillate ones, but somewhat larger and with three–six stamens? These are questions to be answered, and botanists who have an opportunity to study the plants are invited to

make thorough field study on these interesting water-weeds.

The study, as far as it has been done now, has given the following suggestions and conclusions, mostly drawn from the literature on the subject and from herbarium material. There seem to be more than one species, probably six or seven. As far as the material on hand shows, the plant with broad and obtuse leaves, originally described as *Elodea canadensis,* seems to be hermaphrodite; the others all diœcious, not polygamous. The plant which is growing in Europe, supposed to have been introduced from America, and described as *Anacharis Alsinastrum* Babington, resembles *E. canadensis* in habit, but only pistillate flowers have been found, and in these the stigmas are entire. In the North American forms with diœcious flowers the staminate sheaths are sessile in the axils of the leaves, and easily overlooked, except in the plant common in the Rocky Mountain region and one specimen from Tennessee, in which the sheaths are peduncled. In the Rocky Mountain plant the staminate flowers are apetalous.

The subject will be more fully discussed in a paper which Dr. Rydberg is preparing to publish in the *Bulletin* of the club, as soon as more material has been consulted and certain questions can be answered with more definiteness.

Both papers were briefly discussed and adjournment was at 5:30 o'clock.

C. STUART GAGER,
Secretary

THE SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN

THE first regular meeting of the club was held in Science Hall on Tuesday, November 5. Dr. Thos. E. Will, secretary of the American Forestry Association, delivered an address on the general subject of forest preservation, with particular emphasis on the proposed forest reserves in the Appalachian and White Mountains. After pointing out the fact that the timber supply of the United States is disappearing at an alarmingly rapid rate, Dr. Will showed by a series of significant lantern slides the disastrous indirect effects which the removal of the forest-cover produces upon cultivated valleys and slopes, and explained the direct relation between deforestation and the increase in floods. The contrast between western United States, with its large area of forest reserves, and the eastern portion of the country, which has none at all, was clearly brought out by maps thrown on the screen; and the importance of immediately providing such reserves in the eastern mountains for the protection of the streams which rise among them, was made clear to all. At the close of the lecture a resolution was adopted by the club urging congress to enact a law providing the necessary reserves.

ELIOT BLACKWELDER,
Secretary

DISCUSSION AND CORRESPONDENCE

THE EQUATION FOR ONE KILOGRAM OF AIR

TO THE EDITOR OF SCIENCE: It is possible that many teachers of thermodynamics may not have noticed that the characteristic equation for one kilogram of air takes the easily rememberable form $pv = T/10$ when p is measured in standard atmospheres, v in cubic feet, and T in thermodynamic Centigrade degrees, the accuracy of the even integer being fully as great as that of the gas law itself. These units are, of course, a curious mixture of the English and continental systems, but this seldom makes much difference in actual problems, and the convenience of the formula for rough mental computations is sometimes very great.

The data upon which this computation of the gas constant is based are the statements in the third (1905) edition of Landolt and Boernstein that one liter of air under standard conditions weighs 1.2928 grams, and that an American yard is 0.91440 meters, and the value $T_0 = 273.13°$ given by Buckingham in the *Bulletin* of the Bureau of Standards for May, 1907. The value $R = 0.1$ is consistent with these assumptions within less than one fiftieth of one per cent.

The corresponding values of C_p and C_v, reduced from the mean of the results of Regnault (1862), Wiedemann (1876) and

Witkowski (1896), are $C_p = 0.3467$ and $C_v = 0.2467$ cubic-foot atmospheres.

Harvey N. Davis

Cambridge, Mass.

Occurrence of three species of beaked whales of the genus Mesoplodon on the Atlantic coast of the United States

To the Editor of Science: The few specimens of beaked whales of the genus *Mesoplodon* which have hitherto been obtained on the Atlantic coast of the United States have been tacitly assigned to a single species, *M. bidens* (Sowerby). After a detailed study of the material available, I am convinced that three species are represented. These are: (1) *M. bidens*, the species most commonly found in the North Atlantic; (2) *M. europæus*, a species known hitherto only from a single specimen found floating in the English Channel about seventy years ago; and (3) a species which is apparently *M. densirostris*, of which only a few specimens from the Indian Ocean are known.

The name *M. europæus* (Gervais) will probably have to be replaced by *M. gervaisi* (Deslongchamps). The former specific name was originally published in the first edition of Gervais's "Zoologie et Paléontologie françaises" (1846–52) under the genus *Dioplodon*. I have not seen the first edition of this work, but in the second edition (1859) the name is a *nomen nudum*. The species was apparently first described by Deslongchamps in 1866, who renamed it *gervaisi* (*Dioplodon gervaisi*).

An account of the American specimens of this and other genera of ziphioid whales in the National Museum is in preparation, and will probably be published in a few months.

F. W. True

National Museum,
November 5, 1907

Special Articles

Some recent advances in South African paleontology

During the past year a considerable number of new fossil reptiles have been discovered in the Permian and Triassic deposits which are included in the Karroo formation. Three new Therocephalian genera have been discovered in beds which are probably Middle Permian. These are all more or less closely allied to others previously known, and do not reveal much that is new in the general anatomy of the group. In beds which are probably Lower Triassic a new type of Therocephalian has been discovered and named *Arnognathus*. Unfortunately, it is only represented by a dentary bone. The discovery is chiefly interesting from the fact that no Therocephalian has hitherto been got in beds more recent than Upper Permian. It is rather a degenerate form than one leading on to the specialized Cynodonts.

Very much more important than these is the discovery in Lower Triassic beds of the nearly complete skeleton of a small reptile which must be placed in a new suborder. Hitherto we have had no evidence throwing any light on the origin of the Therocephalian reptiles. *Pareiasaurus* and some other of the Cotylosauroid forms seemed to suggest a possible origin among these early types, while one or two points in Mammalian morphology and embryology such as the mammal-like type of the organ of Jacobson in *Sphenodon* seemed rather to favor an affinity with the Rhynchocephalians. The discovery of this new fossil reptile, which is called *Galechirus*, strongly favors the descent of the Therocephalians from an early Rhynchocephaloid ancestor. This new type is about the size of a rat and the following are its most important characters: the dentition is thecodont and homodont, there being no enlarged canine; the lower jaw is very similar to that of the Therocephalians, but there is no enlarged coronoid process; the shoulder girdle is typically Therocephalian, the precoracoid being well developed; the digital formula is 2, 3, 3, 3, 3; the pelvis is plate-like with the ilium directed somewhat backwards; and well-developed abdominal ribs are present. Unfortunately, the temporal region and palate are unknown. The affinities are undoubtedly mainly with the Therocephalians, but in none

of the mammal-like reptiles have abdominal ribs hitherto been found and we may feel quite certain in concluding that in the Anomodonts at least they did not occur, and had they occurred in the Therocephalians it is likely they would have been discovered. The combination of characters seems to point to *Galechirus* being a primitive Therapsidian reptile most closely related to the Therocephalians, but with distinct Rhynchocephaloid affinities. As the American Pelycosaurs are undoubtedly Rhynchocephaloid, it seems not improbable that the common ancestor of the Pelycosaurs and the African mammal-like forms may have been an early Rhynchocephaloid reptile rather than a Cotylosaurian, as some of us had thought.

Another type which I have discovered in the last few months seems in some respects almost as important as *Galechirus* in that it is another "missing link" discovered. A few years ago I pointed out that the old order "Theriodontia" of Owen was an unnatural group including two well-marked divisions—the *Therocephalia* with a Rhyncephalian type of palate, single occipital condyle, simple molars and large angular and surangular bones in the lower jaw, and the *Cynodontia* with a mammalian type of palate, two condyles, complex molars and the lower jaws almost wholly formed by the dentary. The Therocephalians are almost entirely confined to the Middle and Upper Permian beds, the Cynodonts to the Middle and Upper Triassic beds. The new type, which I propose to call *Bauria,* was found in Upper Triassic beds, and while it must be placed among the Cynodonts it shows affinities with the Therocephalians not present in the other known genera. In general shape the skull is not unlike that of *Trirachodon,* but about one half larger than *T. kannemeyeri.* The dental formula is i 4, c 1, m 10 above and apparently the same below. The molars are remarkable by being simple uncusped teeth with flattened tops. There is a secondary palate as in typical Cynodonts, but unlike all previously discovered forms the postorbital arch is incomplete, the postorbital bone not meeting the jugal. The appearance thus produced is very mammal-like. There is apparently no parietal foramen. The squamosal is more like that of the Therocephalians than that of the Cynodonts, and the quadrate is very minute. The occipital condyle is intermediate between that of the Therocephalians and the Cynodonts in that while it is really double the two parts are so close to each other that it is practically single. The lower jaw is almost typically Therocephalian, the angular and surangular being large and the dentary only forming the anterior two thirds of the jaw. While *Bauria* is thus typically Cynodont in the structure of its palate and must therefore be placed in the *Cynodontia,* in the simplicity of its molars, the condition of the occipital condyle, and in the structure of the lower jaw it shows distinct affinities with the more primitive Therocephalians.

In the Lower Triassic beds an imperfect skeleton of a small *Mesosaurus*-like reptile has been discovered. It is less typically an aquatic form and has slender ribs. Abdominal ribs are well developed. The skull, which is imperfectly preserved, is long and pointed and, so far as can be made out, is Rhynchocephaloid in its characters. Until other specimens throw further light on the form it will provisionally be placed in the *Mesosauria.* It has been named *Heleosaurus.*

R. BROOM

VICTORIA COLLEGE,
STELLEN BOSCH, SOUTH AFRICA,
October, 1907

NOTE ON THE FERMENTATIVE REACTIONS OF THE B. COLI GROUP

IN view of the fact that Prescott[1] and others have recorded the presence of organisms resembling *Bacillus coli* on grains, it seemed to us of interest to make a somewhat careful comparison of these forms with intestinal *B. coli* in regard to their power of fermenting carbohydrates. The success of Gordon and Houston[2] in clearing up the relations of the

[1] SCIENCE, N. S., XV., 363; *Medicine,* XI., 20; "Biological Studies" by the pupils of William Thompson Sedgwick, Boston, 1906.

[2] Report of the Medical Officer to the Local

streptococci from various sources by comparison of fermentative power encouraged us to hope for results.

With this end in view, fifty-two cultures of dextrose-fermenting organisms were isolated from human feces. The procedure in all cases consisted in the inoculation, with a small portion of the material, of a fermentation tube from which litmus-lactose-agar plates were made on the first appearance of gas. Of the 52 cultures thus isolated, 5 failed to give a typical reaction in milk, 7 failed to reduce nitrates, 6 formed no indol, and 16 liquefied gelatin. Thirty-one of the 52 cultures proved to be *B. coli,* as determined by the five tests mentioned above, and 25 of them were used for comparative tests in various carbohydrates.

After the work with the intestinal *B. coli* was completed the attempt was made (in the summer of 1907) to secure similar forms from growing grains. Heads of grains and grasses of various sorts were collected from fields in eastern Massachusetts and brought to the laboratory in sterile test-tubes. Portions of perhaps an inch in length were placed in dextrose fermentation tubes and when gas formation began litmus-lactose-agar plates were inoculated. One hundred and seventy-eight samples of grain, however, showed gas in the dextrose tube only 50 times; and 40 samples of grasses failed to show gas at all. Of the 50 samples plated on litmus-lactose-agar only three showed red colonies, and of the organisms isolated all three liquefied gelatin. Time was not available to pursue this investigation further. It seemed to us, however, that our inability to isolate *B. coli* from 218 samples of grains and grasses was in itself of some interest. The experience corresponds with that of Laurent,[3] and Klein, and Houston,[4] but not with the results of Prescott (*l. c.*), and Papasotiriu.[5]

The results obtained with the intestinal *B. coli* may perhaps be of some assistance to workers along similar lines. Each of the 25 cultures studied was inoculated into 12 different fermentable media in fermentation tubes. The basis of the medium was in each case nutrient broth, to which 1 per cent. of the substance to be tested had been added, sterilization being carried out at 100° on three successive days. Two monosaccharides, dextrose and galactose; 5 polysaccharides, lactose, maltose, xylose, saccharose and raffinose; two alcohols, dulcite and mannite, two starch-like bodies, dextrin and inulin, and one albuminoid, nutrose—were used as substances to be fermented.

ACID PRODUCTION BY B. COLI (INTESTINAL)

Acidity in terms of c.c. N/20 NaOH per c.c. of the culture medium. 72 hours' incubation

Culture	Lactose	Maltose	Dextrose	Saccharose	Raffinose	Xylose	Nutrose	Dulcite	Inulin	Dextrin	Mannite	Galactose
1	.3	.2	.3	—.1	.05	.3	.1	.4	0	.2	0	.3
2	.3	.3	.3	0	0	.2	0	.25	.05	.2	.4	.3
3	.3	.35	.3	.3	.3	.3	0	.3	0	.3	.4	.35
4	.3	.25	.3	0	0	.2	0	0	0	.2	0	.25
5	.3	.4	.3	.1	.2	.3	0	.2	0	.2	.4	.4
6	.35	.25	.3	.2	.2	.3	—.05	.4	0	.2	.4	.45
7	.3	.4	.3	0	0	.3	0	.2	.1	.2	.4	.35
8	.3	.2	.3	0	0	.3	—.1	0	.05	.2	0	.3
9	.3	.3	.4	—.05	0	.3	0	.2	0	.4	.4	.3
10	.25	.3	.4	—.05	0	.3	0	.15	0	.2	0	.35
11	.3	.3	.3	—.05	.3	.3	0	.3	.05	.2	.4	.35
12	.3	.4	.3	—.05	0	.3	0	.3	.05	.2	.4	.4
13	.25	.25	.3	—.05	0	.3	—.05	.3	0	.3	.4	.3
14	.25	.35	.4	0	.25	.3	—.05	.35	.05	.1	0	.35
15	.3	.4	.4	.1	.3	.35	0	0	.05	.2	.4	.35
16	.3	.4	.3	0	0	.3	.1	.3	0	.2	.35	.4
17	.3	.25	.4	—.05	0	.25	0	.3	.05	.2	.3	.35
18	.3	.4	.4	0	0	.3	0	.3	.05	.2	.4	.35
19	.3	.4	.3	—.1	0	.35	0	.3	.05	.35	0	.35
20	.3	.4	.3	0	0	.2	0	.3	0	.4	.4	.3
21	.3	.35	.3	0	0	.4	.15	.35	0	.15	.4	.35
22	.3	.4	.3	.15	.3	.3	—.05	.35	0	.2	.4	.35
23	.3	.4	.3	.35	.3	.25	—.05	.35	.2	.2	.4	.35
24	.3	.3	.3	.35	.2	.3	—.05	.3	.05	.3	.4	.4
25	.4	.3	.3	.3	.3	.3	—.05	.4	.05	.1	.4	.45

After 72 hours' incubation at 37° the occurrence of gas formation was observed and the reaction of the medium was determined by titration against *N*/20 NaOH. Uninoculated tubes were, of course, titrated in parallel as controls. The general results of the titrations are indicated in the table below, the acidity in

Government Board for 1902–3; Report of the Medical Officer to the Local Government Board for 1903–4.

[3] *Ann. de l'Inst. Pasteur,* 1899, 13.

[4] Report of the Medical Officer to the Local Government Board for 1899–1900.

[5] *Archiv für Hygiene,* XLI., 204.

each case being the amount of $N/20$ NaOH in c.c., necessary to neutralize one cubic centimeter of the broth, phenolphthalein being used as an indicator. Gas formation coincided with acidity except in the case of dextrin. With this medium acidity was produced in every case, but gas was formed only by cultures 7, 8, 12, 14, 17 and 21.

Inspection of the table shows that all the cultures produced acid in the two monosaccharids; in the polysaccharids, lactose, maltose and xylose, and in the starch-like body, dextrin, the final acidity produced being notably uniform except in the case of dextrin. None of the cultures fermented inulin or nutrose actively, though slight acidity was recorded in one or two cases. No gas was formed in any case in these two media. The other four substances, the polysaccharids, saccharose and raffinose and the two alcohols show diagnostic differences. Seven of the cultures fermented all of these substances; one fermented all but dulcite; one all but saccharose; and one attacked raffinose and dulcite. These ten cultures may be roughly grouped together as organisms of high fermentative power. None of the other fifteen strains produced acid in either saccharose or raffinose. Smith[6] long ago pointed out that saccharose was attacked by some bacteria of the colon group, and not by others. Raffinose is evidently acted on by the same organisms which attack saccharose; and it is of interest to note that these two polysaccharides differ from lactose and maltose in lacking the aldehyde group which shows itself in the reduction of Fehling's solution. The group of organisms, which possess the power of fermenting saccharose, was distinguished by Dunham as *B. coli communior,* and by Ford as *B. communior,* the name *B. coli* being restricted to the type which fails to ferment saccharose. On this basis, Nos. 3, 5, 6, 11, 14, 15, 22, 23, 24 and 25 in the table would be related to *B. communior,* No. 11 varying in failing to act on saccharose, No. 14 failing to ferment saccharose and mannite and No. 15 failing to act on dulcite. Of these ten cultures, only No. 14 formed gas in dextrin.

[6] "Wilder Quarter-Century Book," Ithaca, 1893.

The other fifteen strains are typical *B. coli,* not attacking saccharose or raffinose; but among them several subgroups may be distinguished according to their action on the alcohols and dextrin. Six cultures, Nos. 2, 9, 13, 16, 18 and 20, fermented both alcohols but formed no gas in dextrin. Four cultures, Nos. 7, 12, 17 and 21, fermented both alcohols and did form gas in dextrin. Nos. 4 and 8 formed no acid in the alcohols. Nos. 1, 10 and 19 produced acid in dulcite but not in mannite and no gas in dextrin.

Whether these differences are of systematic significance can only be determined by the examination of a larger series of cultures. MacConkey,[7] in a study of 480 coli-like organisms from feces, found 120 which fermented neither saccharose nor dulcite, 178 which fermented dulcite but not saccharose, 110 which fermented both saccharose and dulcite and 72 which fermented saccharose but not dulcite. Our results, classified in the same way, and ignoring the action upon raffinose and mannite, show 2 cultures in the first group, 15 in the second, 7 in the third and 1 in the fourth.

C.-E. A. WINSLOW
L. T. WALKER
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

[7] *Journal of Hygiene,* V., 333.

CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY

MONTHLY WEATHER REVIEW

No. 8, Vol. XXXV., *Monthly Weather Review,* 1907, contains the following articles:

G. N. Coffey: "Influence of Temperature and Moisture upon the Rate of Growth of Tobacco"; review of Bulletin 39, Bureau of Soils, on "Effect of Shading on Soil Conditions," dealing with experiments on tobacco grown under shade at Tariffville, Conn. The conclusion is: the soil moisture was always sufficient in quantity; the relative humidity had little, if any, influence on the rate of growth, but a decided rise or fall in temperature was followed by an acceleration or diminution, respectively, in the rate of growth of the plants.

W. A. Bentley: "Studies of Frost and Ice Crystals." This paper is intended as a com-

panion memoir to, and an extension of, the same writer's "Studies among the Snow Crystals during the Winter of 1901–2," published in the *Monthly Weather Review*, 1902, XXX., 607–616, pls. I.–XXII.

J. G. C. Cottier: "A Summary of the History of the Resistance of Elastic Fluids"; a posthumous paper, published by permission of the literary executor of Mr. Cottier.

W. P. Stewart: "Local Forecasting at Escanaba, Mich."; brings out several points of local interest, and also the fact that, owing to the protection afforded by Lake Superior, cold waves are more severe to the east and west than at Escanaba.

Dr. Irving Langmuir: "Lightning Phenomena"; note on the curious "beaded trails" of several lightning flashes.

Professor Cleveland Abbe: "Salton Sea and Local Climate"; "the practical question is not how much the Salton Sea can affect climate, but how its waters can be used for irrigating the lands that surround it."

"Tornado at Maple Plain, Minn.," and "Hail-shooting in Italy"; short notes.

Dr. P. Polis: "The New Public Weather Service of Germany"; an interesting account by the head of the Aachen Observatory, who has lately been in the United States studying our weather service.

NILE FLOOD, 1906

An important report on "The Rains of the Nile Basin and the Nile Flood of 1906," by Capt. H. G. Lyons, director general of the Survey Department of Egypt (Cairo, 1907), has been received, and illustrates, in a most striking way, the progress which meteorology is making in Egypt. Here is a report of seventy pages, dealing with the rainfall of a region concerning which practically nothing was known a few years ago. And we learn from this same report that "it is also proposed to investigate the upper region of the monsoon current over the Sudan plains by means of kites carrying self-registering apparatus." The charts given by Capt. Lyons are of much interest, especially those of the seasonal and annual rainfall. These charts extend south to Lake Nyassa. Four isobaric charts cover an area between the equator and lat. 10° N., and east as far as long. 80° E.

SENSIBLE TEMPERATURES

A further contribution to the discussion concerning the "subjective" or "sensible" temperatures, *i. e.*, the temperatures which human beings actually feel, and which depend on temperature, humidity, wind, insolation, and many other factors, is contained in the *Meteorologische Zeitschrift* for October, 1907 (W. Knoche: "Die äquivalente Temperatur: ein einheitlicher Ausdruck der klimatischen Faktoren Lufttemperatur und Luftfeuchtigkeit"). This paper deals with the so-called "äquivalente Temperatur," as originally suggested by von Bezold. If we imagine the water vapor contents of unit volume (1 cu. m.) condensed, and the resulting latent heat of evaporation expended in warming a cubic meter of dry air to a certain temperature, the increase of temperature resulting from the latent heat of evaporation, added to the then prevailing air temperature, gives the "äquivalente Temperatur." This method of expressing the relation of temperature and humidity is followed out for several different stations and climates, and is found to give an excellent indication of the temperature which we actually feel.

R. DeC. Ward

TWO RECENT INTERNATIONAL SCIENTIFIC CONGRESSES[1]

In two congresses composed of members of such dissimilar outlooks as were the congresses at Heidelberg and Amsterdam the differences in the conduct of the congresses were very noticeable. It is generally admitted that in all scientific congresses there are two elements of value, the intellectual and the social. Both elements are to be combined in proper proportion to make the mixture most agreeable and profitable to the individual. In the congress of physiology most emphasis was placed on the presentation of papers; in the congress of psychiatry, neurology and psychology more time and opportunities were given

[1] Physiology, at Heidelberg, August 13–16; Psychiatry, Neurology and Psychology, at Amsterdam, September 2–7, 1907.

for meeting our Dutch hosts and the visiting delegates from other countries.

The physiological congress was composed of teachers of physiology and of other members of national physiological societies, of whom there were about 300 in attendance. Germany supplied less than one third of the members, and sixteen other countries were represented by over 200. The number of papers on the program was about 200. Over half of these were, or included, demonstrations, experiments or lantern views. There were three sections with seven or eight sittings each.

Any one interested in one or more of the subjects—neurology, psychiatry, psychology, care of the insane—could be registered as a member of the Amsterdam congress, and the number of members was correspondingly large, 800. The number of papers was small, 86, if the special papers on asylum management be excluded; with the latter there were 121. The scientific papers were divided as follows: 6 in three general sessions; 17 general discussions and 38 other papers in the section of neurology and psychiatry; seven general discussions and eighteen other papers in the section of psychology and psychophysics. Each section held five sessions.

In both congresses the projection lantern was extensively used for the illustration of results. At the physiological congress there were also many demonstrations on animals which gave to the congress a unique character. Short demonstrations were usually given as parts of the papers that could be illustrated by experiment, and one might see not only the apparatus, but also the obtaining of results by the men who were most familiar with the method. The plan just mentioned might be followed to the advantage of the members in some of our national societies, although it has the slight drawback that it entails considerable extra work on the members of the department where the meetings are held. At the physiological congress microscopic exhibits were also on view during the sessions. It was possible, therefore, to examine the stained sections at leisure, with more profit than from a single brief projection on the screen, and it gave the opportunity of discussing methods and results with the investigator or one of his assistants. This is a most efficacious way to have disputed or doubtful matters cleared up.

An arrangement at the physiological congress of considerable value for the convenience of the members was the posting in each section of the numbers of the papers being read or discussed in the other sections. This was possible because of telephone connections. This enabled the members to move from room to room, or rather from section to section, to hear papers and discussions and to take part in the discussions of the topics that were of special interest to them. At our scientific meetings, and especially at the convocation week gatherings, this method would be exceedingly valuable.

At both congresses there was about an equal number of social meetings, excursions, a dinner, etc. The impression formed by the writer was that at the Heidelberg congress the social gatherings were more formal in character, though not in dress, than at Amsterdam. The meetings were about the same general character, but in some way there did not seem to be so many opportunities of meeting the foreign members as there were in Amsterdam. The formation of country groups was most marked in Heidelberg, probably because the social side usually included sitting at table, while at the congress of psychiatry the formation of such groups was the exception. The different occupations of the members of the two congresses had probably much to do with the social character of the meetings, for the neurologists and psychiatrists must have not only an interest in things (diseases and cases), but also in people, whereas physiologists are occupied with problems dealing little with social matters. The writer would not have the impression left that each congress failed in certain respects toward the visiting members, but there is solely the matter of emphasizing more or less certain aspects of the functions of scientific congresses. At both the members were hospitably and even royally welcomed, at both the scientific papers were equal to the best. It is not intended as a reflection on the committee in either place to say that the scientific side at Heidelberg and the social

side at Amsterdam were the impressive parts of the congresses.

S. I. F.

JOINT MEETING OF MATHEMATICIANS AND ENGINEERS

On the occasion of the annual convocation of the American Association for the Advancement of Science in Chicago during the Christmas holidays, 1907, it is proposed to hold a meeting of mathematicians and engineers under the joint auspices of Sections A and D of the American Association and the Chicago Section of the American Mathematical Society.

The program includes (1) a session on Monday afternoon, December 30, to consider the present status of the teaching of mathematics to students of engineering, both in this country and abroad; (2) a banquet on Monday evening for the promotion of acquaintance and good fellowship among mathematicians and engineers; (3) a symposium on Tuesday morning, December 31, on the topic "What is needed in the teaching of mathematics to students of engineering?" (*a*) What range of subjects? (*b*) To what extent in the various subjects? (*c*) By what methods of presentation? (*d*) What should be the chief aims?

The joint sessions will be held in the Ryerson Physical Laboratory, University of Chicago. Prominent engineers and mathematicians have already promised to take part in this program. It is hoped that a large number of those interested may thus be brought together to discuss these matters of the highest mutual importance. Announcements giving full details of the program and speakers will be mailed in advance of the time of the meeting.

G. A. Miller,
Secretary of Section A of the American Association

W. T. Magruder,
Secretary of Section D of the American Association

H. E. Slaught,
Secretary of the Chicago Section of the American Mathematical Society

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES

The American Association for the Advancement of Science and the national scientific societies named below will meet at the University of Chicago during convocation week, beginning on December 30, 1906.

American Association for the Advancement of Science.—December 30–January 4. Retiring president, Professor W. H. Welch, The Johns Hopkins University, Baltimore, Md.; president-elect, Professor E. L. Nichols, Cornell University, Ithaca, N. Y.; permanent secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; general secretary, President F. W. McNair, Houghton, Mich.

Local Executive Committee.—Charles L. Hutchinson, chairman local committee; John M. Coulter, chairman executive committee; John R. Angell, Thomas C. Chamberlin, Joseph P. Iddings, Frank R. Lillie, Charles R. Mann, Robert A. Millikan, Charles F. Millspaugh, Alexander Smith, J. Paul Goode, local secretary.

Section A, Mathematics and Astronomy.—Vice-president, Professor E. O. Lovett, Princeton University; secretary, Professor G. A. Miller, University of Illinois, Urbana, Illinois.

Section B, Physics.—Vice-president, Professor Dayton C. Miller, Case School of Applied Science; secretary, Professor A. D. Cole, Vassar College, Poughkeepsie, N. Y.

Section C, Chemistry.—Vice-president, Professor H. P. Talbot, Massachusetts Institute of Technology; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

Section D, Mechanical Science and Engineering.—Vice-president, Professor Olin H. Landreth, Union College; secretary, Professor Wm. T. Magruder, Ohio State University, Columbus, Ohio.

Section E, Geology and Geography.—Vice-president, Professor J. P. Iddings, University of Chicago; secretary, Dr. Edmund O. Hovey, American Museum of Natural History, New York City.

Section F, Zoology.—Vice-president, Professor E. B. Wilson, Columbia University; secretary, Professor C. Judson Herrick, University of Chicago.

Section G, Botany.—Vice-president, Professor C. E. Bessey, University of Nebraska; secretary, Professor F. E. Lloyd, Desert Botanical Laboratory, Tucson, Arizona.

Section H, Anthropology.—Vice-president, Professor Franz Boas, Columbia University; secretary, George H. Pepper, American Museum of Natural History, New York City.

Section I, Social and Economic Science.—Vice-president, Dr. John Franklin Crowell, New York City; secretary, Professor J. P. Norton, Yale University, New Haven, Conn.

Section K, Physiology and Experimental Medicine.—Vice-president, Dr. Ludvig Hektoen, University of Chicago; secretary, Dr. Wm. J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

Section L, Education.—Vice-president, Hon. Elmer E. Brown, U. S. Commissioner of Education; acting secretary, Professor Edward L. Thorndike, Teachers College, Columbia University, New York City.

The American Society of Naturalists.—December 28. President, Professor J. Playfair McMurrich, University of Toronto; secretary, Professor E. L. Thorndike, Teachers College, Columbia University, New York City. Central Branch, president, Professor R. A. Harper, University of Wisconsin; secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The American Mathematical Society. Chicago Section, December 30, 31. Chairman, Professor Edward B. Van Vleck; secretary Herbert E. Slaught, 58th St., and Ellis Ave., Chicago, Ill.

The American Physical Society.—President, Professor E. L. Nichols, Cornell University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society.—December 27–January 2. President, Professor Marston T. Bogert, Columbia University; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

The Association of American Geographers.—December 31–January 1. Acting-president, Professor R. S. Tarr, Cornell University, to whom correspondence should be addressed; secretary, Albert P. Brigham, 123 Pall Mall, London, Eng.

The Association of Economic Entomologists.—December 27, 28. President, Professor H. A. Morgan, Knoxville, Tenn.; secretary, A. F. Burgess, Columbus, Ohio.

The American Society of Biological Chemists.—December 30–January 2. President, Professor Russell H. Chittenden, Yale University; secretary, Professor William J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

The Society of American Bacteriologists.—December 31–January 2. Vice-president, F. D. Chester, Delaware Agricultural College, Newark, Del.; secretary, Professor S. C. Prescott, Massachusetts Institute of Technology.

The American Physiological Society.—Beginning December 31. President, Professor W. H. Howell, Johns Hopkins University; secretary, Professor Lafayette B. Mendel, 18 Trumbull St., New Haven, Conn.

The Association of American Anatomists.—January 1–3. President, Professor Franklin P. Mall; secretary, Professor G. Carl Huber, 1330 Hill St., Ann Arbor, Mich.

The American Society of Zoologists.—Central Branch. Secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The Botanical Society of America.—December 27–29. President, Professor George F. Atkinson, Cornell University; secretary, Dr. D. S. Johnson, Johns Hopkins University.

The Botanists of the Central States.—Business Meeting. President, Professor T. H. Macbride, University of Iowa; secretary, Professor H. C. Cowles, University of Chicago, Chicago, Ill.

The American Psychological Association.—December 27, 28. President, Dr. Henry Rutgers Marshall, New York City; acting secretary, Professor R. S. Woodworth, Columbia University, New York City.

The Western Philosophical Association.—Secretary, Dr. John E. Bowdoin, University of Kansas, Lawrence, Kans.

The American Anthropological Association.—December 30, January 4. President, Professor Franz Boas, Columbia University; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-lore Society.—December 30–January 4. President, Professor Roland B. Dixon, Harvard University; secretary, Dr. Alfred M. Tozzer, Harvard University, Cambridge, Mass.

Other national societies will meet as follows:

NEW HAVEN

The American Society of Zoologists.—Eastern Branch. December 26, 28. President, Dr. C. B. Davenport, Cold Spring Harbor, N. Y.; secretary, Professor W. L. Coe, Yale University, New Haven, Conn.

The American Society of Vertebrate Paleontologists.—December 26–28. President, Professor Bashford Dean, Columbia University; secretary, Professor Frederick B. Loomis, Amherst College, Amherst, Mass.

NEW YORK

The American Mathematical Society.—December 27, 28. President, Professor H. S. White, Vassar College; secretary, Professor F. N. Cole, Columbia University.

ALBUQUERQUE, N. M.

The Geological Society of America.—December 30–January 4. President, President Charles R. Van Hise, University of Wisconsin; secretary, Dr. Edmund O. Hovey, American Museum of Natural History, New York City.

ITHACA

The American Philosophical Association.—December 26, 28. President, Professor H. N. Gardiner, Smith College; secretary, Professor Frank Thilly, Cornell University, Ithaca, N. Y.

NEXT SUMMER, AT SOME PLACE TO BE DETERMINED

The Astronomical and Astrophysical Society of America.—President, Professor Edward C. Pickering, Harvard College Observatory; secretary, Professor Geo. C. Comstock, Washburn Observatory, Madison, Wisconsin.

THE ANNUAL DUES OF MEMBERS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The permanent secretary of the American Association for the Advancement of Science begs to call the attention of members to the fact that the annual dues (three dollars) for the year beginning January the first should now be sent to him. The financial year of the association will hereafter end on October 31, and the dues for the following calendar year should be paid as soon as possible after that date. The dues are so small and the membership of the association has become so large that the sending of statements involves an expenditure of time and money, which, so far as possible, should be saved. The office of the permanent secretary must be removed to the place of meeting at Chicago during the last week in December, and the dues should be paid prior to that time. If they are not paid before January 1, there are serious complications in regard to the sending of Science to members. The association can not make itself responsible for sending Science to those whose dues are in arrears, as there are some who may regard the non-payment of dues as equivalent to resignation from the association. The back numbers of Science will be sent to those who pay their dues after January the first upon the payment to the publishers of postage, so far as the edition permits, but the publishers do not guarantee that this will be done. Should the edition threaten to become exhausted, it will be necessary for those who wish to keep their sets of Science complete to pay for the numbers.

The permanent secretary takes this occasion to remind members of the desirability of assuming life membership in the association. By the payment of fifty dollars at the present time, all future trouble and expense is avoided. The fees of life members are ultimately transferred to the permanent fund, the income of which is used exclusively for the encouragement of research, and those who assume life membership thus contribute materially to the advancement of science. L. O. Howard,

Permanent Secretary

Smithsonian Institution,
Washington, D. C.

SCIENTIFIC NOTES AND NEWS

An oil portrait of Professor James Mills Peirce, Perkins professor of mathematics at Harvard University until his death in 1905, has been presented to the university by his sister.

The gold medal of the British Institution of Mining and Metallurgy, has been awarded to Sir Archibald Geikie in recognition of his services to geological science. The Consolidated Gold Fields of South Africa gold medal and premium have been awarded to Dr. T. Kirke-Rose for researches on the metallurgy of gold.

Dr. Robert Koch has been promoted to the rank of Wirklicher Geheimer Rath, with the title of Excellency, in recognition of his researches into the causes of the sleeping sickness.

Dr. J. A. Allen, curator of mammalogy and ornithology in the American Museum of Natural History and editor of *The Auk*, has been elected an honorary member of the Deutsche Ornithologische Gesellschaft; he has also been transferred from the foreign to the honorary class of members of the British Ornithologists' Union.

DR. R. W. WOOD, professor of experimental physics in the Johns Hopkins University, has been awarded the John Scott legacy premium and medal for his discoveries in color photography by the Franklin Institute of Philadelphia. The institute has awarded Mr. H. E. Ives of the physics department the Edward Longstreth medal for improvements on the method.

THE Walsingham medal of Cambridge University for 1907 has been awarded to E. Mellanby, formerly research student at Emmanuel College, for his essay on the metabolism of creatinin and creatin.

AT a meeting of the London Mathematical Society on November 14, the following officers were elected: President, Professor W. Burnside; vice-presidents, Professor A. R. Forsyth and Professor H. M. Macdonald; treasurer, Professor J. Larmor; secretaries, Professor A. E. H. Love and Mr. J. H. Grace.

DR. GEORGE T. LADD, emeritus professor of philosophy in Yale University, has returned from Japan to his home in New Haven.

THE *Journal* of the New York Botanical Garden states that Professor C. F. Baker, for three years past chief of the department of botany in the Estación Central Agronómica, at Santiago de las Vegas, Cuba, has been appointed curator of the herbarium and botanic garden at the Museu Goeldi, Para, Brazil. His special work there will be the further development of the herbarium and garden at Para, and the botanical exploration of some of the most interesting parts of the Amazon valley.

DR. C. B. ROBINSON, assistant curator of the N. Y. Botanical Garden, has been appointed economic botanist of the Bureau of Science of the Government of the Philippine Islands.

PROFESSOR C. L. DE MURALT, of the University of Michigan, has returned from Europe, where he has been supervising the electrification of the Altberg tunnel beneath the Tyrolean Alps.

PROFESSOR ALBERT PERRY BRIGHAM is on leave during the present year. He has spent the summer and autumn in geological field work under Dr. John M. Clarke, of the New York State Museum, and sailed on November 28 for Genoa, to join his family in Geneva. He will spend the winter in Geneva, and the rest of the year in travel in southern Europe, attending the International Geographical Congress in Geneva in July, and returning to college duties in September.

PROFESSOR G. D. HARRIS, of Cornell University and state geologist of Louisiana, has begun this season's field work in the south. He plans to make a large collection of the recent and Quaternary shells of the gulf border and will collect at Cedar Keys, Tampa, Biloxi, New Orleans and Galveston. Then visiting Jennings and Beaumont and passing westward into Texas, he will complete last winter's study of the Louisiana and Texas oil fields.

DR. RAYMOND H. POND, who has been studying at the New York Botanical Garden during the past year, sailed for Europe on November 7 to spend several months in visiting German botanical laboratories.

THE Hamburg Institute for Ship and Tropical Diseases is sending Drs. Keysselitz and Mayer to German East Africa to study protozoan diseases in man and animals. Their headquarters are to be at Amani.

KING EDWARD has granted to Sir Frederick Treves, Bart., serjeant-surgeon, Thatched House Lodge as a residence. The house is one of the three lodges in Richmond Park.

THE address of the retiring president of the Philosophical Society of Washington will be given by Mr. John F. Hayford, of the U. S. Coast and Geodetic Survey, on December 7. His subject is "The Earth, a Failing Structure."

AT a meeting of the fern class of the Botanical Society of Pennsylvania, on November 23, the members present signed appropriate resolutions containing an appreciation of the earnest and fruitful labors of the late Professor Lucien M. Underwood, and the same have been forwarded to Professor N. L. Britton, of the New York Botanical Garden.

WE regret to record the death of Professor Asaph Hall, one of the most distinguished of

American astronomers. Born in Goshen, Conn., in 1829, he became assistant at the Harvard College Observatory, and from 1863 was professor in the United States Naval Observatory, carrying on his important researches until his retirement in 1895, when he was appointed professor at Harvard University. Dr. Hall was president of the American Association for the Advancement of Science in 1902.

Dr. George F. Shrady, editor of the *New York Medical Record* since its foundation in 1866 to 1904, and the author of numerous contributions to medical science, died in New York City on November 29, at the age of seventy years.

Professor R. Kossmann has died in Berlin, at the age of 58, from the results of septic infection. He was at first a zoologist and later devoted himself to medicine, particularly gynecology.

Professor Alfred D. Cole, of Vassar College, Poughkeepsie, N. Y., secretary of Section B—Physics—of the American Association for the Advancement of Science has sent the following notice to members of the section:

The annual meeting of the American Association for the Advancement of Science will be held at the University of Chicago, from December 30, 1907, to January 4, 1908. The American Physical Society will meet at the same time and the usual arrangement for joint sessions for the reading of papers will doubtless be made. The joint meeting in New York, a year ago, was one of the most successful gatherings of physicists ever held in the country, and it is hoped that this Chicago meeting will be equally good.

The presiding officer of Section B is Professor Dayton C. Miller, of the Case School of Applied Science, and the address of the retiring vice-president will be given by Professor W. C. Sabine, of Harvard University.

A single program for all sessions will be issued on the opening day of the meeting, and it is desired to send out a preliminary program by December 15. Therefore promptness in sending in titles of all papers to be presented before Section B is urgently asked.

The organization meeting of the Illinois State Academy of Sciences will be held in the Senate Chamber, Springfield, Ill., on December 7. The preliminary program is as follows:

10 A.M.—Call to order and election of chairman.

Address of welcome, by Governor Charles S. Deneen.

"Advantage of a State Academy," by Professor T. C. Chamberlin, LL.D., University of Chicago.

"History of the former State Natural History Society," by S. A. Forbes, Ph.D., State Entomologist.

Appointment of committees and other business.

2 P.M.—Report of committees.

Symposium (ten-minute addresses), Outlook for Young Men in:

Anthropology, by Geo. A. Dorsey, Ph.D., Field Museum.

Botany, by John G. Coulter, Ph.D., Central Illinois State Normal.

Chemistry, by Wm. A. Noyes, Ph.D., University of Illinois.

Geology, by H. Foster Bain, Ph.D., State Geologist.

Physics, by C. E. Linebarger, Lake View High School.

Zoology, by Herbert V. Neal, Ph.D., Knox College.

8 P.M.—Popular lecture in the Arsenal:

"Greater Steps in Human Progress," by W J McGee, LL.D., director of the St. Louis Public Museum.

On November 21 about one hundred members of the Society of Municipal Engineers of the City of New York visited Columbia University and inspected the buildings and laboratories.

There have been ordered for the earthquake station at the University of Michigan the following instruments: A 200-kilogram pendulum of the Wiechert type and model of 1907; a 160-kilogram Wiechert pendulum of 1907 model for measuring the vertical component of the earth's motion, and a pair of 25-kilogram Bosch-Omori or Strasburg horizontal pendulums of the latest model. These instruments will be installed in the astronomical observatory of the University which is directed by Professor W. J. Hussey.

Rev. Dr. Bonney has presented to the Sedgwick Museum, Cambridge, the whole of his collection of rock slices, consisting of 2,700

specimens, of which the British examples number about 1,300. The latter represent especially the rocks of Cornwall, Charnwood, the Wrekin, the Bunter pebbles, North Wales, Scotland, and the Channel Islands. The European collection contains some 450 specimens collected from different parts of the Alps, Brittany, and the Ardennes. There is also a large collection of specimens from the Himalayas, Novaya Zemlya, Ararat, Canada, Rocky Mountains, Andes, Ecuador, Bolivia, Aconcagua district, Socotra, and the diamantiferous district of South Africa.

THE sixth annual meeting of the South African Association for the Advancement of Science will be held at Grahamstown during the week ending July 11, 1908, under the presidency of the Hon. Sir Walter Hely-Hutchinson.

THE Fourth Congress of the Bohemian Men of Science and Physicians will be held in Prague in the summer of next year.

THE foundation of the Royal Society of Medicine was celebrated by an inaugural dinner at the Hotel Cecil, London, on Tuesday, December 3.

THE dinner of the fellows and associates of the British Institute of Chemistry, to celebrate the thirtieth anniversary of the foundation of the institute, took place on November 22 at the Hôtel Métropole, London, Professor Percy F. Frankland, the president, being in the chair. The company, which numbered about 200, included the presidents of the Chemical Society, the Iron and Steel Institute, the Institution of Civil Engineers, the Royal College of Surgeons, the Society of Chemical Industry, the Institute of Actuaries, the Institution of Mining and Metallurgy, the Society of Public Analysts, and the chairman of the Board of Inland Revenue.

AN Italian Society of Radiology was founded on the occasion of the Second Congress of Physiotherapy recently held in Rome.

THE fourth volume of "Die Karcinomliteratur" (edited by Dr. Sticker, Berlin) shows that during the last five years there appeared 3,395 publications dealing with cancer. Six hundred and seven of these were in English.

FREE lectures maintained by the Lowell Institute in the Teachers' School of Science, mainly under the auspices of the Boston Society of Natural History, will be given during the season as follows:

"Field Lessons in Botany," by Mr. Hollis Webster.

"Field Lessons in Zoology," by Mr. Albert P. Morse.

"Field Lessons in Geology," by Professor George H. Barton.

"Laboratory Lessons in Botany," by Mr. Hollis Webster.

"Laboratory Lessons in Zoology," by Mr. Albert P. Morse.

"Laboratory Lessons in Geology," by Professor George H. Barton.

"Laboratory Lessons in Geography," by Professor Douglas W. Johnson.

"Lectures and Demonstrations in Physical Chemistry," by Professor G. N. Lewis.

The British Medical Journal says: "It was stated in this column of the *British Medical Journal* of October 26 that there is a probability of the *Index Medicus* being discontinued, and that in view of this contingency it has been suggested that the card system of the Concilium Bibliographicum might be extended so as to cover the ground of medical literature. Reference was made to the fact that a similar plan was tried in Paris some time ago, but did not find adequate support. Dr. Marcel Baudoin writes to point out that during the period of occultation of the *Index Medicus,* which lasted from 1900 to 1903, its place was supplied by the *Bibliographia Medica,* published in Paris under the auspices of the Institut de Bibliographie, of which our correspondent was the directing spirit. On the reappearance of the *Index Medicus,* the *Bibliographia Medica,* finding its occupation gone, joined the snows of yesteryear. In 1906 it was followed by the Institut de Bibliographie, which, as Dr. Baudoin reminds us, was the first effort in that direction. The failure of two such meritorious enterprises is not encouraging to further adventures of the same kind. Yet the value of a general index to current medical literature is beyond question, and the need of such a guide through a labyrinth ever growing in vastness and in

complexity must necessarily make itself felt more and more by workers who wish to follow the course of medical thought, and are not content to take their references at second-hand."

Statistics collected by the United States Geological Survey show that Colorado still outranks any other state or territory in the union, including Alaska, in the production of the precious metals, despite the fact that the gold production of the state in 1906 fell short nearly $2,000,000 of that of 1905, the precise figures being, output $23,210,629, decrease $1,813,344. More than half of the total gold of the state is derived from the telluride veins of Cripple Creek in Teller County. San Miguel free-milling ores contribute nearly $2,500,000. The smelting ores of Leadville, in Lake County, yielded $1,500,000 and the partly free-milling Gilpin County ores over $1,000,000. San Juan County and Ouray County both closely approached the million-dollar mark. Important diminution in the output is recorded in Teller and Ouray counties, but this was partly offset by gains in San Miguel and other counties. Siliceous and dry ores formed 67 per cent of the total tonnage and were the source of over 96 per cent. of the gold product. The placer output is comparatively small. The outlook for 1907 does not indicate the probability of great increase, if any. The production of silver, 12,216,830 ounces, showed an increase of 717,523 ounces. The smelting ores of Lake County led in the output, with nearly 4,000,000 ounces, while in their order Pitkin, San Miguel, Mineral, San Juan, Ouray and Clear Creek counties are next in importance, the first three exceeding the million mark. A higher price increased the value of the product. The increase is due chiefly to the veins of San Juan, San Miguel and Mineral counties. On the other hand, the yield of the Leadville and Aspen deposits diminished. About half of the silver product of the state is derived from siliceous or dry ores, 28 per cent. from lead ores and 17 per cent. from zinc or zinc-lead ores. No great change is expected in the production of silver for 1907. The Geological Survey will publish during December an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," containing a discussion by Waldemar Lindgren, geologist, of the gold and silver production of the United States in 1906.

UNIVERSITY AND EDUCATIONAL NEWS

The memorial committee of the Alumni Association of the University of Michigan has the satisfaction of seeing the foundations laid of the future Memorial Hall. The contract which has been let calls for the enclosed building only, without the internal furnishings, for $107,103.00. The university has promised an additional $50,000 as soon as the sum raised reaches $132,000.00. The building, which stands on the southwest corner of the campus, will contain, in addition to the Memorial Hall, which is to be lined with tablets, paintings, and statues of famous alumni of the university, accommodations for the entire art collection of the university, a small but convenient auditorium, and accommodations for the Alumni Association, as well as a room for social gatherings.

Professor Cleveland Abbe, of the United States Weather Bureau, has presented to the Johns Hopkins University a collection of books and pamphlets dealing with meteorology.

Dr. Scofield, of Benson, Minn., has presented the valuable geological collection that was left him by his father to the University of Minnesota.

The botanical department of Syracuse University has announced several new courses in forestry for next year. Dr. W. L. Bray, appointed to succeed Dr. J. E. Kirkwood, as professor of botany, is interested in forestry, and it is said that the new courses will probably lead to the establishment of a department of forestry.

Docents O. Grosser and O. Stoerk have been named, respectively, an extraordinary professor of anatomy and extraordinary professor of pathological anatomy, in the University of Vienna.

Dr. Edward Baban has been named titular professor of physiology in the Bohemian University of Prague.